THE PHILIPPINE
JOURNAL OF SCIENCE

VOL. 59 MARCH, 1936 No. 3

BIRDS NEW AND RARE IN THE PHILIPPINES

By RICHARD C. MCGREGOR

Chief, Publications Division, Department of Agriculture and Commerce

and

CANUTO G. MANUEL

Ornithologist, Fish and Game Administration, Bureau of Science, Manila

This paper contains notes on birds twelve species of which are now recorded in the Philippines for the first time, one species whose previous collection in this country appears doubtful, and eight that represent additional records of species rare in the Archipelago.[1]

PTERODROMA ROSTRATA TROUESSARTI Brasil.

May 24, 1926, Mr. Santos Dacia shot a male petrel on the shore of Laguna de Bay in Los Baños, Laguna Province, Luzon. It was mounted and presented to the Department of Entomology, College of Agriculture, University of the Philippines. Later the specimen was turned over to the Bureau of Science where it was dismounted.

This petrel (Bureau of Science collection, No. 26554) obviously is a straggler from New Caledonia where previous specimens are reported(1) to have been obtained. It has the following measurements: Length, 397 mm; wing, 287; tail, 122; culmen, 36; tarsus, 46. This bird must have been carried by a southeast monsoon, which is generally prevalent in the Tropics(10) south of the Equator from about April to October. Accordingly the bird traversed several islands and bodies of water before it came to the Philippines. It probably went through northeastern Aus-

[1] We are indebted to the Rev. Fr. Miguel Selga, S. J., director of the Philippine Weather Bureau, for information regarding the direction of winds at certain seasons of the year.

tralia and intervening islands northwestwardly to southeastern Borneo, thence northward until it reached the Equator. North of the Equator the wind blows from the southwest,(10) which would change the direction of its flight. By seeking refuge along the shore of eastern Borneo, the bird probably traveled northward to eastern Palawan, thence by western Mindoro to Luzon, until it located itself in an inland lake for shelter after a wearisome journey. From the appearance of the route taken by this bird, the distance covered could not have been made in only one or two months. It, therefore, probably started its journey sometime during the previous year. In this connection the records of the Philippine Weather Bureau, which show that there was no trade wind immediately previous to May 25, 1926, to favor the flight of this petrel from its native haunts, are significant. This is the first Philippine record of this species.

COOKILARIA LEUCOPTERA HYPOLEUCA (Salvin).[2]

A male white-breasted petrel (Bureau of Science collection, No. 30029) was obtained from G. Taguibao, according to whom the bird was purchased from a man who shot it along the shore of Manila Bay November 21, 1935. It was lame when Taguibao got it for mounting. This species(6) has been recorded as breeding in the Hawaiian group and Bonin Islands, and this specimen represents a new and interesting record for the Philippines.

November 10 to 20, 1935, a strong typhoon hit the northern part of Luzon. According to the Philippine Weather Bureau the typhoon originated in the Pacific Ocean (East Quadrant), which includes the habitat of this species. It is probable that the species is an aberrant visitor to Philippine waters and that this bird was driven by the typhoon to the coast of northern Luzon. From there it may have sought refuge along the western coast of Luzon until it entered Manila Bay.

PUFFINUS LEUCOMELAS (Temminck).

A male white-fronted petrel (Bureau of Science collection, No. 30027) had apparently lost its sense of direction when it struck the bright lights at Pier 7, in Manila. This, according to the night watchman on that wharf, was the cause of the unconsciousness of the bird which he caught in February, 1935. The watchman sold the bird to Mr. Fidel H. Alonte, in charge of the Manila Aquarium, from whom it was obtained for the collection.

[2] See Proc. U. S. Nat. Mus. 16 (1893) 617–618.

This petrel has the following measurements: Length, 471 mm; wing, 310; tail, 153; culmen, 48.5; tarsus, 44.5; middle toe with claw, 67.5.

The only other record of this species in the Philippines was made by Cuming in 1836,(8) also in winter, from Luzon. Cuming's bird is in the British Museum.

NYROCA FERINA (Linnæus).

An adult male pochard(13) was shot by Mr. Modesto Flores from a fishpond in Hagonoy, Bulacan Province, Luzon, November 19, 1927. The bird (Bureau of Science collection, No. 29157), which is perhaps a straggler from its winter home in China,(18) has the following measurements: Length, 475 mm; wing, 205; tail, 75; culmen, 50; tarsus, 30. A white spot at the apex of the chin is very distinct. This is the first Philippine record of this species.

PERDIX BARBATA Verreaux and Des Murs.

A bearded partridge (Bureau of Science collection, No. 30028) was presented by Mr. G. Castañeda. The bird was shot near Fort William McKinley reservation, in Balagbag, Rizal Province, September 18, 1931. It is the first known recapture of this introduced species. Mr. H. C. Whittal, to whom the introduction of the Chinese francolin into the island has been attributed, states that he and five friends brought about twenty birds of this species from Hongkong in 1915. According to him they were all liberated in several places between Balagbag and Fort William McKinley.

COTURNIX COTURNIX JAPONICA Temminck and Schlegel.

A male Japanese gray quail(15) was caught with a net by a trapper at Novaliches (near Manila), Rizal Province, Luzon, November 29, 1930. The bird was purchased by Francisco S. Rivera, who gave it to the collection. The specimen (Bureau of Science collection, No. 29861), which represents a new record for the Philippines, possesses the following measurements: Length, 170 mm; wing, 102; tail, 36; culmen from nostril, 10; tarsus, 24. The bird is perhaps a straggler from Formosa.(11)

TURNIX WORCESTERI McGregor.

A female Worcester's button quail (Bureau of Science collection, No. 8812), was obtained from a bird vender. The bird was trapped in Parañaque, Rizal Province, July 26, 1934. *Turnix worcesteri* is now definitely known to occur in the rice fields about Parañaque, a few kilometers south of Manila.

There are four specimens of this species recorded,(7) including the type. They were purchased in a local market.

SCOLOPAX RUSTICOLA Linnæus.

In a hunt for game birds with the use of a light—a common illegal practice in certain regions—a male woodcock(14) was caught in Santo Tomas, Pampanga Province, Luzon, on the night of December 4, 1929. The bird was purchased by an American, who kindly donated it to the collection. McGregor's notes on the original tag read, "Taken with light. Bill fuscous to fuscous-black at tip, base of lower mandible cartridge buff. Legs and toes drab. Nails fuscous-black." The bird (Bureau of Science collection, No. 28138) possesses the following measurements: Length, 360 mm; wing, 195; culmen, 75; tail, 83 (rectrices lacking); tarsus, 35. This is the first Philippine record of this species. This bird may have come with the snipes (*Capella megala, C. gallinago,* etc.) that winter here annually.

Mr. G. Castañeda presented us with another specimen of the woodcock shot outside the military reservation, near Fort William McKinley, Rizal Province, Luzon, September 18, 1931.

LIMNOCRYPTES MINIMA (Brünnich).

A male jack snipe(14) was shot by Francisco S. Rivera in a vacant rice field in Apalit, Pampanga Province, Luzon, November 23, 1930. It was with a number of *Capella megala* Swinhoe. It is very probable that jack snipes [3] and woodcocks (*Scolopax rusticola*) occasionally come to the Philippines with a flock of other snipes.

The jack snipe from Apalit (Bureau of Science collection, No. 29155), which constitutes an addition to the list of Philippine birds, has the following measurements: Length, 210 mm; wing, 115; culmen, 42; tail, 55; tarsus, 23.

PHILOMACHUS PUGNAX (Linnæus).[4]

An immature ruff was caught in a rice field in Bulacan Province September 9, 1929, by Francisco S. Rivera. Due to baffling characters presented by this bird (Bureau of Science collection, No. 30026), it is considered best to present its description.

Forehead buff, spotted with brownish black. Crown, indicating a young plumage, buff streaked with black. Greater and median coverts brownish buff, darker near tips. Feathers of

[3] In September, 1934, many of these birds were reported by sportmen from Laguna and Camarines Norte Provinces.

[4] We are indebted to Director F. N. Chasen, of the Raffles Museum, for identifying this young specimen.

upper surface with buffish white fringe. Dark regions glossed with light greenish brown. Three longest tertiaries barred near tips with one whitish buff acute band each. Lower back, rump, and upper tail coverts ashy brown; in general appearance similar to but darker than hind neck. Lateral upper tail coverts pure white. Rectrices smoky brown, with black submargin and white tips; three median pairs barred with black and white near tips. Chin and throat grayish white, growth distinctly juvenile. Foreneck and breast brownish buff with their distal fifth gray. The breast fades gradually into white on flanks, abdomen, and under tail coverts. Axillars white with submarginal black bars.

Bill black, flesh-colored at base of lower mandible. Tibiotarsus transversely scaled both before and behind; yellowish brown in preserved specimen. Toes webbed; web of outer with middle toe more pronounced than that of middle with inner. Inner toe slightly shorter than outer; middle longest. Hind toe elevated. Length, 275 mm; culmen, 185; tail 75; exposed tibia, 30; tarsus, 47.

This young ruff was probably a straggler from Ceylon, Tennaserim, or Assam, where the species has been recorded(16) as a winter visitor. This is a new Philippine record.

PSEUDOTOTANUS GUTTIFER (Nordmann).

This species is probably an occasional winter visitor in the Philippines although in comparatively small numbers. McGregor and Celestino obtained one male and two females November 16 and 17, 1906, in Minglanilla, Cebu Province. December 17, 1927, they obtained four males in Obando, Bulacan Province. All the birds are in winter plumage according to Stuart Baker.(16)

The known winter range of this species, according to Stuart Baker,(16) is northeastern India, Burma, Malay Peninsula, and Hainan. The records presented indicate that the Philippines is the southernmost extension of its winter range.

LARUS ARGENTATUS VEGÆ Pontoppidan.

Francisco S. Rivera and Anacleto C. Duyag obtained a female Vega herring gull(3) on the coast of Manila Bay at Obando, Bulacan Province, Luzon, October 25, 1928.

Measurements of the specimen (Bureau of Science collection, No. 27200) are as follows: Length, 535 mm; wing, 420; tail, 172; culmen, 49; tarsus, 60.

The bird is probably a vagrant from its winter home in China(18) by way of Formosa.

The only other record of this species in the Philippines is of a specimen supposed to have been obtained by B. Schmacker in

1896. The bird(3) is now in the Bremen Museum. Unfortunately, however, the accuracy of its origin is now questioned. It is contended(3) that Schmacker himself did not collect the bird in the Philippines.

HYDROPROGNE CASPIA (Pallas).

A male Caspian tern was shot by Mr. Basilio Hernandez January 4, 1931, on the shore of Manila Bay in the vicinity of Binuangan, Obando, Bulacan Province, Luzon. The bird was perhaps a straggler from Formosa where this species is believed(11) to be a resident.

It is probable that a strong northeast wind, prevalent in November, December, and January, carried this tern to the Islands.

The original label, which reads, "Bill coral red, dusky towards tip, extreme tip paler. Leg and tarsus walnut brown, joints, toes, webs, nails, black," was written by McGregor. The specimen (Bureau of Science collection, No. 26098) has the following measurements: Length, 510 mm; wing, 387; culmen, 66; tail, 135; tarsus, 40. This is the first Philippine record of this species.

GELOCHELIDON NILOTICA Gmelin.

The first Philippine record of this species was made by McGregor and party, who obtained a male bird at Puerto Princesa, Palawan, October 8, 1925. October 27, 1928, Francisco S. Rivera and Anacleto C. Duyag secured three males and three females at Obando, Bulacan Province, Luzon. F. S. Rivera collected two males at Obando August 6, 1930. Manuel obtained two females on the coast of Panay Gulf in western Occidental Negros October 8, 1933. These repeated records tend to show that this species is a regular visitor to the Philippines. The above-mentioned specimens have the following measurements:

Measurements of Gelochelidcn nilotica Gmelin.

	Average from Obando.		Palawan, male.	Average from Negros, females.
	Males.	Females.		
	mm.	*mm.*	*mm.*	*mm.*
Wing	273.0	273.6	305	285.0
Tail	149.6	112.6	139	123.5
Culmen	38.6	34.1	37	35.0
Tarsus	31.38	29.1	30	28.7

For lack of sufficient material for comparison, the subspecific designation of the Philippine form cannot now be given.

Mathews(4) recommended six subspecies for this species. He indicated the measurements of the culmen of the Javanese and of the Chinese races as 36 mm and 36 to 37 mm, respectively. The table presented above shows that the Philippine subspecies, based on the measurement of the culmen, is similar to the Javanese and the Chinese subspecies. When material is available it may be found that the Chinese, Philippine, and Javanese forms belong to the same subspecies, which perhaps breeds in China and winters in the Philippines, Borneo, and occasionally in Java.

ASIO FLAMMEUS (Pontopiddan).

Three female short-eared owls(2) were collected near Binuangan, Bulacan Province, Luzon, December 30, 1927, by McGregor and party. They are of about the same size, and one of them, measured when fresh, had a length of 37 cm. The average measurements of the skins are: Length, 367 mm; wing, 325; culmen, 30; tail, 145; claws, 27 to 29. These represent an addition to the known species of Philippine birds.

CLAMATOR COROMANDUS (Linnæus).

An interesting record of the crested cuckoo in Luzon was made by Domiciano Villaluz who obtained the bird (Bureau of Science collection, No. 29154) in Angono, Rizal Province, December 20, 1932. The only other three records of this species in the Philippines are quoted by McGregor(8) from Bourns and Worcester's manuscript, who state that Everett obtained one specimen in Mindanao, while they got one in Siquijor and one in Palawan. All these birds are in foreign institutions. This species appears to be a straggler to the Philippines.

HIRUNDAPUS CELEBENSIS DUBIUS (McGregor).

Mr. Francisco P. Domingo shot a female giant swift in Ipo, Norzagaray, Bulacan Province, Luzon, September 7, 1935. According to the collector a number of swifts were flying very high so that he was lucky in bringing one of them down.

This bird (Bureau of Science collection, No. 13409) presents an interesting case systematically. The deep steel-blue color characteristic of *Hirundapus celebensis celebensis* (Sclater) is distinct. On the other hand the color of the underside of the wings is peculiarly *H. c. dubius* (McGregor). From the description(3) it appears that *H. c. celebensis* and *H. c. dubius* differ only in minor characters, so that when sufficient numbers

are compared they may be found to be identical. However, until the status of the two subspecies is decided, this bird is tentatively named *H. c. dubius*.

Measurements of the Domingo specimen are: Wing, 222 mm; tail, 75; culmen from nostril, 7; tarsus, 19; middle toe with claw, 25.

ZANTHOPYGIA NARCISSINA (Temminck).

In 1921 McGregor(9) reported the second Philippine record of the Narcissus flycatcher, which he and Andres Celestino secured in Calayan in 1903. The first record was a male bird obtained by J. B. Steere(12) in Mindanao in 1874. Three other specimens obtained since 1903 are here reported. A female (Bureau of Science collection, No. 28748) was collected by McGregor and party at Limay, Bataan Province, November 23, 1924. In November, 1933, two males of this species were added to the Bureau of Science collection. One of these (Bureau of Science collection, No. 28859) was picked up unconscious by Mr. Wallace Adams from the floor of the building then occupied by the Fish and Game Administration. The building is close to the shore of Manila Bay, and the bird was perhaps so exhausted by its flight that it struck the wall of the building and dropped to the floor. Four days afterwards (November 7) the other bird (Bureau of Science collection, No. 28860) was obtained by Manuel from a boy who shot it with a slingshot. According to the boy the beautiful color of the bird struck his attention. The bird was perched on a branch of a citrus tree about three meters from the ground, looked sickly, and was easily killed.

PRIONOCHILUS PARSONSI McGregor.

An extension of the range of this species was noted when five birds, consisting of three males and two females were obtained by Francisco S. Rivera on Mount Irid, Rizal Province, November 16, 17, and 18, 1926. It is interesting to note that the type locality (Malinao, Tayabas) is 121° 38′ east, 14° 44′ north, while Mount Irid is 121° 20′ east, 14° 47′ north. Both places are in the Sierra Madre Mountain Range.

CHLORURA BRUNNEIVENTRIS Ogilvie-Grant.

Two male bamboo weavers were secured by Francisco S. Rivera near Majayjay, Laguna Province, Luzon. One (Bureau of Science collection, No. 26483) was obtained April 10, 1928, and the other (Bureau of Science collection, No. 26484) was collected August 27, 1929. Whitehead's(17) contention that

they were always difficult to obtain appears to be confirmed by the long interval between these records and that made by him in Mindoro in 1895, and by McGregor in 1905. The type specimen of this rare bird is in the British Museum (Natural History).

ERYTHURA TRICHROA (Kittlitz).

In 1921 McGregor(8) recorded a species of bird suspected to be *E. trichroa*. At that time he was not sure whether the species was resident or migratory. In 1934 Manuel was given a statement by a German professional bird collector, attributed to a known European ornithologist, to the effect that *E. trichroa* provides an interesting case of migratory habits in that from its home in the Solomon Islands the species winters in Mindanao. This would mean that it moves northwestward in winter crossing the Equator. Unfortunately, we are unable to locate the literature verifying this statement.

During the period from April to July, 1935, peddlers commonly sold this species in Manila. The birds are kept in small bamboo cages. According to some of the peddlers, the birds feed on the seeds of buho, *Schizostachyum lumampao*, and on weed seeds. They are caught in large numbers in many places around Manila. Undoubtedly, the species has established itself in Luzon. In a number of visits made by Manuel to boats plying between Australia and Hongkong docked in Manila harbor, these birds are observed in large cages. They were purchased in Australia, where the species is also known to occur,(5) to be sold in Hongkong. Information was obtained that occasionally local Chinese bird venders buy birds from these transient merchants. It is possible, therefore, that *E. trichroa* was introduced here through this agency.

The Indian red munia, *Amandava amandava* (Linn.), was introduced here in the same manner.

LITERATURE CITED

1. Brasil, M. L. Notes sur la fauna ornithologique de l'Oceanie. Bull. du Mus. Nat. d'Hist. Nat. 23 (1917) 432–436.
2. Delacour, J., and P. Jabouile. Les Oiseux de L'Indochine Francaise. Paris 2 (1931) 131–132.
3. Hachisuka, Masauji. Birds of the Philippine Islands. London 1 pt. 2 (1932) 185, 329.
4. Mathews, Gregory M. The Birds of Australia. London 2 (1912) 330–331.
5. Mathews, Gregory M. The Birds of Australia. London 12 (1925) 208–210, 1 pl.

6. MATHEWS, GREGORY M. A check-list of the order Procellariiformes. Nov. Zool. 39 (1934) 170.
7. MCGREGOR, R. C. Bull. Philip. Mus. 4 (1904) 8–9, pl. 1.
8. MCGREGOR, R. C. Manual of Philippine Birds. Manila (1909) 85, 365.
9. MCGREGOR, R. C. New or noteworthy Philippine birds, IV. Philip. Journ. Sci. 19 (1921) 701.
10. MEYER, A. B., and L. W. WIGLESWORTH. The Birds of Celebes and the Neighboring Islands. Berlin (1898) 18–19, map 3.
11. OGILVIE-GRANT, W. R., and J. D. D. LA TOUCHE. On the birds of the island of Formosa. Ibis 1 (1907) 270, 276.
12. SHARPE, R. BOWDLER. On the birds collected by Prof. J. B. Steere in the Philippine Archipelago. Trans. Linn. Soc. London 1 (1877) 327–351.
13. STUART BAKER, E. C. The Game Birds of India, Burma and Ceylon. (Ducks and their allies.) 1 (1921) 259–266, pl. 24.
14. STUART BAKER, E. C. The Game Birds of India, Burma and Ceylon. (Snipes, Bustards, and Sand Grouse.) 2 (1921) XVI + 328, 25 pls. 2 maps.
15. STUART BAKER, E. C. The Game Birds of India, Burma and Ceylon. Journ. Bombay Nat. Hist. Soc. 29 (1923) 591–593.
16. STUART BAKER, E. C. The Fauna of British India (Birds) 6 (1929) 227–229.
17. WHITEHEAD, JOHN. Field-notes on birds collected in the Philippine Islands in 1893–6 Part II. Ibis 5 (1899) 242.
18. WILDER, G. D., N. GIST GEE, and LACY I. MOFFETT. Chinese Birds. Bull. Peking Soc. Nat. Hist. 1 (1926–27) 24, 93.

A REVIEW OF PHILIPPINE PIGEONS, II
SUBFAMILY PTILINOPODINÆ

By CANUTO G. MANUEL

Ornithologist, Fish and Game Administration, Bureau of Science, Manila

The present paper contains a review of Philippine fruit pigeons belonging to the subfamily Ptilinopodinæ based on the material in the collection of birds of the Philippine Bureau of Science, Manila.

The subfamily Ptilinopodinæ is an artificial group for the reason that there are no trenchant structural characters peculiar to it. This must have caused the confusion among the early systematists of this group. The birds may, however, be described as arboreal pigeons of medium size; bill weak; distal portion of first primary attenuated; tarsus feathered for more than half its length; soles broad, that of hind toe broadest. In the Philippines four genera of pigeons may be recognized on this basis.

Judging from specimens examined and from scattered literature about this group of Philippine pigeons, it appears that more collecting is necessary for an exhaustive treatise on the subject. Among those who have had occasion to study systematically Philippine specimens of this group may be mentioned Gray, Bonaparte, Verreaux and Des Murs, Schlegel, Elliot, Oustalet, Meyer, Salvadori, McGregor, and Hachisuka. Pertinent citations of the works of these investigators are enumerated at the end of this paper.

The genus *Ptilinopus* was proposed by Swainson (1825). Strickland (1841) questioned the word on the basis of its derivation. He asked if it should not be *Ptilopus* instead.

The first application of this generic name to a Philippine bird was made by Gray (1844) when he named *Ptilonopus occipitalis*. Mitchell prepared the illustration of the bird in that publication.

Due to the growing complexity and confusion, Bonaparte (1854) split the subfamily into two series, and the series Ptilopodes into six genera. He described *Trerolæma* (=*Leucotreron*) *leclancheri*, the second Philippine representative of the group.

Unfortunately many of his proposed names were based upon immature stages of named species, thus presenting more confusion to later systematists. Confronted with the difficulties of following Bonaparte's scheme, Elliot (1878) retained the large genus (*Ptilopus*) with seventy-one species. The many specimens that Elliot examined enabled him to eliminate those names that were synonyms of valid names. Still many species were either omitted or unnecessarily included in the list. Two Philippine species, *Ptilopus occipitalis* and *P. leclancheri*, were, however, enumerated.

Oustalet (1880) described *Ptilopus marchei*, the third Philippine species of this group known.

Guillemard (1885) recorded *Ptilopus formosus* Gray (=*Ptilinopus temminckii*) from Sulu, the fourth species of the group in the Philippines.

The fifth species of the group was named by Meyer (1891) as *Ptilopus bangueyensis*.

When Salvadori (1893) prepared the catalogue of pigeons in the collection of the British Museum, he indicated Ptilopodinæ as one of the three subfamilies of Treronidæ. He also divided the genus *Ptilopus* into twelve subgenera and placed *occipitalis*, *leclancheri*, and *marchei* under the subgenus *Leucotreron*. Obviously, the condition of the first primary (abruptly attenuated on apical portion), the long tail, and the absence of a defined cap on the upper part of the head were used as subgeneric characters. Moreover, *Ptilopus temminckii* was placed in the subgenus *Lamprotreron*, and *P. bangueyensis* in the subgenus *Spilotreron*. Bifurcated pectoral feathers is the main character used for segregating *Lamprotreron* from *Leucotreron*. The condition of the distal portion of the first primary was used principally in separating *Spilotreron* from the two subgenera named above.

McGregor and Worcester (1906), following Sharpe, gave *Leucotreron*, *Lamprotreron*, and *Spilotreron* generic rank; they recorded *occipitalis*, *marchei*, and *leclancheri* as species of *Leucotreron;* *temminckii* as a species of *Lamprotreron;* and *bangueyensis* as a species of *Spilotreron*. This scheme was upheld by McGregor in a later publication (1909), then describing the pigeons of the genus *Leucotreron* as forest inhabiting, with both webs of the first primary greatly reduced in width near the tip, the tail square, and the tarsus feathered for more than half its length. In other respects the characters used by Salvadori, for the separation of subgenera, were adapted by McGregor for generic distinction. The same author (1916) described *Leuco-*

treron merrilli, the sixth species, and later (1918) suggested that *L. marchei* and *L. merrilli* be placed under the subgenus *Neoleucotreron,* the decomposed and lengthened barbs of the secondaries to be used as a diagnostic character.

Mathews (1911) used *Leucotreron* for a group of Australian pigeons, giving the normal pectoral feathers, the rather long tail, and the comparatively short under tail coverts as the basis for separation. The principal character given for the genus *Ptilinopus* is the bifurcated pectoral feathers.

Richmond (1917) brought to light that *Hæmatæna* should replace *Spilotreron.*

Hachisuka (1930) enumerated two genera with four species of Philippine ptilinopodine pigeons. In a later publication (1932), the same author enumerated four genera (*Hæmatæna, Leucotreron, Neoleucotreron,* and *Ptilinopus*) with three others and classified them under the subfamily Treroninæ. He described *Leucotreron leclancheri palawana* and raised *Neoleucotreron* to generic status with the species *marchei* and *merrilli,* citing McGregor's suggestion for his action.

In a recent paper, Manuel (1936) described the new races *Neoleucotreron merrilli faustinoi* and *Leucotreron leclancheri longialis.*

In view of the foregoing statements, *Ptilinopus* Swainson (1825) is a valid name and has priority over *Ptilopus. Leucotreron, Neoleucotreron,* and *Hæmatæna* should be segregated as distinct genera, because of the peculiar diagnostic characters each group presents.

Key to the genera of Philippine ptilinopodine pigeons.[1]

a[1]. Pectoral feathers normal.
  b[1]. Outer and inner webs of secondaries uniform.
    c[1]. Webs of distal third of first primary gradually and slightly attenuated ..... *Hæmatæna.*
    c[2]. Webs of distal fifth of first primary abruptly and distinctly attenuated ..... *Leucotreron.*
  b[2]. Outer webs of majority of secondaries with barbules decomposed, lengthened, and distinctly colored..... *Neoleucotreron.*
a[2]. Pectoral feathers bifurcated..... *Ptilinopus.*

Genus HÆMATÆNA Bonaparte, 1857

Distal third of first primary gradually and slightly attenuated; tail rounded; general color nearly uniform grass green;

[1] Genera and species recorded by other writers but not examined in the present study are enumerated but not discussed in this paper.

males with gray head patched with black on occiput and yellow on throat.

HÆMATÆNA MELANOCEPHALA BANGUEYENSIS (Meyer).

Ptilopus bangueyensis MEYER, Journ. für Orn. (1891) 70.
Spilotreron bangueyensis McGREGOR and WORCESTER, Hand-list Birds Philip. Is. (1906) 11.
Ptilinopus melanocephala bangueyensis HARTERT, Nov. Zool. 10 (1903) 33.
Hæmatæna melanocephala enantia OBERHOLSER, Journ. Wash. Acad. Sci. 14 (1924) 296–297.
Hæmatæna melanospila bangueyensis HACHISUKA, Birds Philip. Is. 1 (1932) 192–193.

Mindanao, Basilan, Sulu Archipelago, Banguey, Palawan, Cagayan Sulu.

Specimens from Basilan and Jolo Islands were examined.

Measurements of Hæmatæna melanocephala bangueyensis (Meyer) based on five males and eight females.

	Extremes. mm.	Mean. mm.
Wing	115.0–124	120.1
Tail	68.0–83	80.7
Culmen	14.5–15	14.7
Tarsus	20.0–21	20.3
Middle toe and claw	24.0–27	25.3

This species has been placed in the genus *Spilotreron*. Richmond (1917), however, indicated why *Spilotreron* should be replaced by *Hæmatæna*. Some systematists adapted *melanospila* as the specific name, while others used *melanocephala; melanocephala* (1781) antedates *melanospila* (1875), and should, therefore, be used. *Hæmatæna m. bangueyensis* is the northern race of the species, as previous students have shown distinction from closely related forms to be regionally slight.

Genus LEUCOTRERON Bonaparte, 1854

Distal fifth of first primary abruptly and distinctly attenuated; general color of upper parts grass green.

Two species are recognized from the Philippines.

Key to the Philippine species of Leucotreron.

a[1]. Chin white; under tail coverts light buff, inner webs largely green. *L. occipitalis.*

a[2]. Chin black; under tail coverts light cinnamon..... *L. leclancheri.*

LEUCOTRERON OCCIPITALIS (Gray).

Ptilonopus occipitalis GRAY, Gen. Birds 2 (1844) pl. 118.
Ramphiculus occipitalis BONAPARTE, Compt. Rend. 39 (1854) 878.

Omeotreron batilda BONAPARTE, Compt. Rend. 39 (1854) 878.
Lamprotreron porphyrea BONAPARTE, Icon. Pig. (1857) pl. 15.
Leucotreron occipitalis MCGREGOR and WORCESTER, Hand-list Birds Philip. Is. (1906) 10.
Leucotreron occipitalis occipitalis HACHISUKA, Cont. Birds Philip. No. 2 (1930) 147.

The Philippine Archipelago, except the Batanes, the Babuyanes, and the Palawan groups.

Specimens from Luzon, Mindoro, Sibuyan, Samar, Cebu, Negros, Mindanao, (Agusan, Surigao, Davao), and Basilan were examined.

Measurements of Leucotreron occipitalis (Gray) based on seventeen males and six females.

	Extremes. mm.	Mean. mm.
Wing	145.0–162.0	154.4
Tail	111.0–119.0	113.3
Culmen	14.0– 16.0	14.53
Tarsus	22.5– 26.5	23.96
Middle toe and claw	29.5– 34.0	31.1

Nearly all previous workers recognized Bonaparte as the authority for this species. Gray (1844), however, should be given credit on account of a plate that accompanied the indication.

Eight specimens from Mindanao (Surigao, Agusan, and Davao) were examined. No difference was observed between them and those from other parts of the Philippines. Hachisuka (1930) described *L. o. brevipes* from four specimens collected on Mount Apo. However, the wing measurement which Hachisuka used cannot be a valid character, as the length he gave tallies with those obtained in this study. In a later publication (1932) he revived *L. o. incognitus* (Tweeddale), making his *brevipes* a synonym of that species and indicating Mindanao as the locality. Tweeddale originally described a young female of *L. o. occipitalis* from Agusan and called it *Xenotreron incognita.* The small amount of gray on the head, which Hachisuka (1932) used for separating *L. o. incognitus* from the typical race, is, obviously, an age difference, according to the material examined in this study.

LEUCOTRERON LECLANCHERI LECLANCHERI (Bonaparte).

Trerolæma leclancheri BONAPARTE, Compt. Rend. 41 (1855) 247.
Leucotreron gironieri VERREAUX and DES MURS, Ibis (1862) 342, pl. 12.
Ptilopus hugoniana SCHLEGEL, Ned. Tijds. Dierk. (1863) 60–61.
Ptilopus leclancheri SALVADORI, Cat. Birds Brit. Mus. 21 (1893) 79–80, pl. 3.

Leucotreron leclancheri McGREGOR and WORCESTER, Hand-list Birds Philip. Is. (1906) 10.

Leucotreron leclancheri leclancheri HACHISUKA, Birds Philip. Is. (1932) 186–187.

Luzon, Lubang, Mindoro, Catanduanes, Samar, Sibuyan, Tablas, Romblon, Panay, Negros, Cebu, Bohol, Guimaras, Cagayancillo, Calamianes, Palawan.

Specimens from Luzon, Polillo, Mindoro, Romblon, Ticao, Tablas, Bohol, Biliran, Bantayan, Cagayancillo, and Semirara were examined.

Measurements of Leucotreron leclancheri leclancheri (Bonaparte) based on seventeen specimens of each sex.

	Extremes. mm.	Mean. mm.
Wing	138–155	146.1
Tail	100–114	105.1
Culmen	13– 16	14.78
Tarsus	19– 23	20.66
Middle toe and claw	27– 32	28.1

Although the head, throat, and breast are pearly gray in breeding males and largely cedar green in breeding females, various shades between these two colors are encountered in those of the different stages of both sexes. The black chin, however, is constant, while the size and appearance of the seal brown pectoral band is variable.

Considered by McGregor (1909) to range throughout the Philippine Archipelago. The validity of *Leucotreron leclancheri palawana* Hachisuka (1932), however, will eliminate Palawan and possibly Calamianes from the range of the typical race. Likewise, evidence to differentiate birds from the Batanes and the Babuyanes (Manuel, 1936) will exclude those islands from the range of the typical subspecies.

LEUCOTRERON LECLANCHERI PALAWANA Hachisuka.

Ptilopus leclancheri EVERETT, Proc. Zool. Soc. London (1889) 225.

Leucotreron leclancheri McGREGOR and WORCESTER, Hand-list Birds Philip. Is. (1906) 10.

Leucotreron leclancheri palawana HACHISUKA, Birds Philip. Is. 1 pt. 2 (1932) 187.

Palawan.

No specimen was examined for this study.

LEUCOTRERON LECLANCHERI LONGIALIS Manuel.

Leucotreron leclancheri McGREGOR, Bull. Philip. Mus. No. 4 (1904) 6, 9; Philip. Journ. Sci. § A 2 (1907) 338, 345.

Leucotreron leclancheri leclancheri HACHISUKA, Birds Philip. Is. 1 (1932) 186–187.

Leucotreron leclancheri longialis MANUEL, Philip. Journ. Sci. 59 (1936) 307.

The Batanes and Babuyanes, of northern Philippines.

Specimens from Calayan, Camiguin, and Batan were examined.

Measurements of Leucotreron leclancheri longialis Manuel based on two males and one female.

	Male. mm.	Male. mm.	Female. mm.
Wing	160	161	164
Tail	119	121	118
Culmen	[a] 15	16	18
Tarsus	22	20	25
Middle toe and claw	31.5	31	35

[a] Tip of culmen broken.

Distinctly longer wings and tail have been used primarily for separating this subspecies from typical *L. l. leclancheri.* It may be noted that after determining the species of the bird from Batan, McGregor wrote on the label, "Large for this species" (*Leucotreron lechancheri*).

Genus NEOLEUCOTRERON McGregor, 1918

First primary slightly and gradually attenuated near end. Barbules of outer webs of most secondaries decomposed near edge and distinctly colored; some decomposed barbules lengthened, producing an irregular overgrowth in contour of outer web. Habitat, the mountains of Luzon and Polillo.

Two species are known.

Key to the species of Neoleucotreron.

a[1]. Tail, 135 mm or longer; center of breast bright orange-vermilion. *N. marchei.*

a[2]. Tail, 125 mm or shorter; breast greenish gray..... *N. merrilli.*

NEOLEUCOTRERON MARCHEI (Oustalet).

Ptilopus (*Rhamphiculus*) *marchei* OUSTALET, Le Naturaliste (1880) 324–325.

Leucotreron marchei MCGREGOR and WORCESTER, Hand-list Birds Philip. Is. (1906) 10.

Neoleucotreron marchei HACHISUKA, Birds Philip. Is. 1 (1932) 189–190.

Luzon.

Specimens from Mount Tabuan, Cagayan Province; Polis Mountains, Mountain Province; and Mount Casiguran, Tayabas Province, Luzon, were examined.

Measurements of Neoleucotreron marchei (Oustalet) based on two males and three females.

	Extremes. mm.	Mean. mm.
Wing	173.0–188	179.9
Tail	145.0–153	146.0
Culmen	16.0– 17	16.3
Tarsus	27.0– 29	27.9
Middle toe and claw	34.5– 37	35.7

Top of head, cheeks, and sides of throat dull crimson; a large patch on breast orange blending into vermilion-red. Mantle, back, and greater part of wings dusky black. Lower back and rest of wings with a greenish sheen.

NEOLEUCOTRERON MERRILLI MERRILLI (McGregor).

Leucotreron merrilli McGREGOR, Philip. Journ. Sci. § D 11 (1916) 269–271.

Neoleucotreron merrilli HACHISUKA, Cont. Birds Philip. No. 2 (1930) 148.

Neoleucotreron merrilli merrilli MANUEL, Philip. Journ. Sci. 59 (1936) 307.

Mountains of eastern and southern Luzon and Polillo.

Specimens from the Sierra Madre Mountain near Tanay, Rizal Province; and near Paete, Laguna Province, both in Luzon, and from Polillo were examined.

Measurements of Neoleucotreron merrilli merrilli (McGregor) based on three males and two females.

	Extremes. mm.	Mean. mm.
Wing	161–167	163.2
Tail	117–118	117.4
Culmen	14– 15	14.6
Tarsus	23– 27	24.4
Middle toe and claw	33– 34	33.4

Forehead, crown, and sides of head and throat gull gray tinged with green on occiput. Lower breast and abdomen buffish white separated from greenish gray of upper breast by a narrow dark green band that describes an arc in the pectoral region.

NEOLEUCOTRERON MERRILLI FAUSTINOI Manuel.

Neoleucotreron merrilli faustinoi MANUEL, Philip. Journ. Sci. 59 (1936) 307.

Mount Tabuan, Cagayan Province, Luzon. Two males examined. Wing, 168 mm, 168; tail, 118, 121.5; culmen, 16, 15; tarsus, 26.5, 25.5; middle toe and claw, 39, 36.

A patch of van dyke red on crown distinguishes this race from *N. m. merrilli.*

Although the two subspecies of *Neoleucotreron merrilli* are mountain forms, the habitat of *N. m. faustinoi* is in altitude higher than that of *N. m. merrilli.*

PTILINOPUS TEMMINCKII (Des Murs and Prevost).

Kurukuru temminckii PREVOST and DES MURS, Voy. Venus. V. Zool. (1855) 234.

Ptilopus formosus GUILLEMARD, Proc. Zool. Soc. (1885) 269.

Lamprotreron temminckii MCGREGOR and WORCESTER, Hand-list Birds Philip. Is. (1906) 11.

Ptilinopus temminckii HACHISUKA, Birds Philip. Is. 1 pt. 2 (1932) 191.

Celebes and Sulu.

One male and one female from Celebes, but no Philippine specimens were examined.

LITERATURE CITED

BONAPARTE, CHARLES-LUCIEN. Coup d'oeil sur l'ordre des Pigeons. Compt. Rend. 39 (1854) 875–879.

BONAPARTE, CHARLES-LUCIEN. Iconographie des Pigeons (1857) pl. 15.

ELLIOT, D. G. On the fruit-pigeons of the genus Ptilopus. Proc. Zool. Soc. London (1878) 500–575.

EVERETT, A. H. Remarks on the Zoo-geographical relationships of the island of Palawan and some adjacent islands. Proc. Zool. Soc. London (1889) 225.

GRAY, G. R. The Genera of Birds 2 (1844) pl. 118.

GUILLEMARD, F. H. H. Report on the collections of birds made during the voyage of the Yacht Marchesa,—I. A provisional list of the birds inhabiting the Sulu Archipelago. Proc. Zool. Soc. London (1885) 269.

HACHISUKA, MASAUJI. Contributions to the birds of the Philippines No. 2 (1930) 147, 148.

HACHISUKA, MASAUJI. Birds of the Philippine Islands 2 pt. 2 (1932) 184–193.

HARTERT, ERNST. On the birds collected on the Tukang-Besi Island and Buton, south-east of Celebes, by Mr. Heinrich Kuhn. Nov. Zool. 10 (1903) 33.

MANUEL, CANUTO G. New Philippine fruit pigeons. Philip. Journ. Sci. 59 (1936) 307.

MATHEWS, GREGORY M. The Birds of Australia 1 pt. 2 (1911) 100, 103.

MCGREGOR, RICHARD C. The birds of Calayan and Fuga, Babuyan group. Bull. Philip. Mus. No. 4 (1904) 6, 9.

MCGREGOR, RICHARD C. The birds of Batan, Camiguin, Y'Ami, and Babuyan Claro, islands north of Luzon. Philip. Journ. Sci. § A 2 (1907) 338, 345.

MCGREGOR, RICHARD C. A Manual of Philippine Birds. Bur. Sci. Publ. No. 2 (1909) 37–42.

McGREGOR, RICHARD C. New or noteworthy Philippine birds, I. Philip. Journ. Sci. § D 11 (1916) 269–271; II, Philip. Journ. Sci. § D 13 (1918) 2.

McGREGOR, RICHARD C., and DEAN C. WORCESTER. Hand-list of the Birds of the Philippine Islands. Bur. Gov't. Labs. No. 36 (1906) 10, 11.

MEYER, A. B. Ueber einige Tauben von Borneo und den Philippinen. Journ. für Orn. (1891) 70.

OBERHOLSER, HARRY C. Descriptions of new Treronidae and other non-passerine birds from the East Indies. Journ. Wash. Acad. Sci. 14 (1924) 296–297.

OUSTALET, E. Description de deux oiseaux nouveaux de la collection du muséum d'histoire naturelle de Paris. Le Naturaliste 1 (1879) 324–325.

PREVOST, F., and O. DES MURS. Voyage autour du monde sur la frégate La Venus, pendant les annees, 1836–1839. Zoologie Oiseaux 5 (1885) 234.

RICHMOND, CHARLES W. Generic names applied to birds during the years 1906 to 1915, inclusive, with additions and corrections to Waterhouse's "Index Generum Avium." Proc. U. S. Nat. Mus. 53 (1917) 593.

SALVADORI, T. Catalogue of the Columbae, or pigeons, in the collection of British Museum. Cat. Bds. Brit. Mus. 21 (1893) 70–144.

SCHLEGEL, H. Notice sur trois espéces inédites de pigeons du genre Ptilopus. Ned. Tijds. Dierk. 1 (1863) 60–61.

STRICKLAND, H. Commentary on Mr. G. R. Gray's Genera of Birds 1840. Ann. & Mag. Nat. Hist. 7 (1841) 36.

SWAINSON, WILLIAM. On the characters and natural affinities of several new birds from Australasia; including some observations on the Columbidae. Zoological Journ. 1 (1825) 473–474.

VERREAUX, JULES, and O. DES MURS. Description d'une nouvelle espéce de Pigeon du genre Leucotreron. Ibis (1862) 342, pl. 12.

LIFE HISTORIES OF SOME COMMON BIRDS IN THE VICINITY OF NOVALICHES RIZAL PROVINCE, LUZON, I

THE LARGE-NOSED SHRIKE, LANIUS SCHACH NASUTUS (SCOPOLI)

By Dioscoro S. Rabor

Of the Fish and Game Administration, Bureau of Science, Manila

ONE PLATE

INTRODUCTION

The large-nosed shrike, *Lanius schach nasutus* (Scopoli), is commonly met in Philippine fields and meadows. It is known by different names, as "pakiskis," "tarat San Diego," "tarat mamumugot" (Tagalog provinces); "verdugo," "mamumungot" (Cebu); and "palal" (Ilocano provinces).

The entire top and sides of the head of the adult, as well as the sides and back of the neck, are black. The mantle is light gray shading into ocherous-buff on the scapulars, back, rump, and tail coverts. The underparts are white for the most part, although some traces of ocherous-buff are seen coming from the sides. The sides and flanks are ocherous-buff. The crissum is light buff. The thighs are white. The wings and tail are black; the inner webs of the wing quills are edged with white. The third to the tenth primaries [1] show a small white spot near the base of the outer webs, appearing as a distinct white spot when the wing is folded. The inner secondaries have pale buff edges and tips, changing to white in some specimens. The wing, the first alular quill, and the first and second primaries have white edges. The rectrices have narrow pale buff or white tips with the two outermost pairs with pale buff or white margins. All the rectrices have pale buff fringes at the base. The iris is brown. The bill, legs, and nails are black. Ten males average: Length, 238.8 mm; wing, 88.7; tail, 125.8; cul-

[1] McGregor, R. C., A Manual of Philippine Birds, 595, gives "fifth to eighth."

men, 17.7; tarsus, 25.5; middle toe with claw, 23. Seven females average: Length, 224.5 mm; wing, 88; tail, 121.2; culmen, 17; tarsus, 25.3; middle toe with claw, 22.7.

There is no marked sex dimorphism in the adult, although in the male the blackness of the top of the head is more intense. Also, during the nesting season, the male looks more groomed than the female, who neglects the proper care of the plumage during that period.

The young, when ready for flight, differs rather markedly from the adult in the following characteristic features: The entire top of the head, hind neck, and sides of the neck are finely vermiculated with buff and brownish black; the individual feathers are brownish black, edged with buff. The lores and a strip below the eye to the auriculars are brownish black. A broad pale buff band is present above the eye. The mantle is heavily barred with buff and brownish black, with the individual feathers exhibiting gray bases, ocherous-buff tips, and very narrow, brownish black, subterminal bars. The back, rump, and tail coverts are ocherous-buff ranging to light chestnut, with narrow, brownish black, subterminal bars on the individual feathers. The white of the chin and throat gradually changes into buff on the breast, and shades into pale buff on the abdomen. The buffy sides and flanks show faint, narrow, brownish black, subterminal bars on the individual feathers. The crissum is buff; the thighs pale buff. The wings and tail are brownish black, the inner webs of the wing quills with white edges. The third to the tenth primaries show a small pale buff spot near the base of the outer webs, appearing as a distinct spot when the wing is folded. The inner secondaries have ocherous-buff edges and tips, ranging to light chestnut. The wing, the first alular quill, and the first and second primaries have pale buff edges. The primary coverts have white tips; the greater and middle coverts have buff edges and tips. The rectrices have buff edges and tips, the two outermost pairs are buff for the most part, clearest on the outer webs of the outermost pair. All the rectrices have buff fringes at the base. The iris is brown. The bill is yellowish black with bright yellow edges to the mandibles. The gape and the inner lining of the buccal cavity are bright yellow. The legs and nails are horn-colored. The tail is rather short, typically, about 30 mm long.

The large-nosed shrike is, according to McGregor (1909), widespread in Luzon and in most of the islands of the Archipelago.

The present studies carried on in Novaliches, Rizal Province, Luzon, have been made in order to bring to light pertinent facts relative to the breeding of the species, whose life history, like that of most Philippine birds, is practically unknown. Observations were carried on with the aid of field glasses (8x).

HAUNTS AND HABITS

Observations were made in an area of approximately 8 square kilometers immediately adjacent to the Novaliches water reservation.

The site is open rolling country, consisting mainly of grassy areas with irregular patches of bush and tall-tree growth along the small creeks, which usually dry up during the warm months. Here and there are cultivated areas planted to various crops during the different seasons of the year. A plantation of mango, *Mangifera indica* Linn.,[2] is included in the area under observation. The majority of the trees are of medium growth and reclining on the ground, having fallen down during a typhoon. Madre cacao, *Gliricidia sepium* (Jacq.) Steud., is the commonest hedge plant around the cultivated areas. The district is sparsely peopled.

The large-nosed shrike frequents open country, preferring a grass-and-madre-cacao community as described above. It frequently perches on the top of a fence post, a bush, or a small tree, from where it keeps a lookout for insects in the grass below. Whitehead (1899), writing on the habits of this species, noted the same remarkable fact. From time to time it swoops down on the insects, catching them on the wing, sometimes alighting on the ground and staying there for some time, hopping after the intended prey until it is able to catch and kill it with the strong hooked bill. The victim is firmly grasped in the powerful bill of the shrike and taken to the nearest favorable perch where it is consumed.

The bird is noisy. When excited, it gives forth a harsh note closely resembling that of the gray-headed shrike, *Lanius cristatus lucionensis* Linnæus, which frequents the same locality. The commonest note approaches the syllables "keek-keek-keek-keek-etc.," repeated several times in succession. A casual observer will easily mistake the note of this species for that of the gray-headed shrike. However, the note of the large-nosed shrike has a much more intense degree of harshness.

[2] Mr. Edilberto Karganilla, of the National Museum Division, Bureau of Science, identified the plants mentioned in this paper.

The notes of the species are not by any means always the characteristic harsh shrieks. The bird is also quite a notable singer. Perching on a favorite limb or bush top, it sometimes bursts into song, weaving into its melody the notes of different birds. The following interesting observation has been noted in this connection:

May 20.—A bird, perched on top of a mango tree, began to sing. It was a very nice melody consisting of a mixture of call notes of different birds. It trilled the sweet high note of the yellow-breasted sunbird, *Leptocoma jugularis jugularis* (Linnæus), then changed into the soft call of the dominico, *Copsychus mindanensis* (Boddaert). Then, it launched abruptly into the harsh note of the black-and-white fantail, *Rhipidura javanica nigritorquis* Vigors, and suddenly switched into the soft modulated tones of the pied lalage, *Lalage nigra schisticeps* Neumann. It continued singing, for the composition was quite a long melody, and woven further into its song were the notes of the golden-headed cisticola, *Cisticola exilis rustica* Wallace; pied chat, *Saxicola cuprata caprata* (Linnæus); white-collard kingfisher, *Sauropatis chloris collaris* (Boddaert); guava bulbul, *Pycnonotus goiavier goiavier* (Scopoli); black-naped flycatcher, *Hypothymis azurea azurea* (Boddaert); Philippine bulbul, *Iole gularis* (Pucheran); Derby's tailorbird, *Orthotomus derbianus* Moore; gray-backed coleto, *Sarcops calvus calvus* (Linnæus); striated marsh warbler, *Megalurus forbesi* Bangs; Philippine rail, *Rallus torquatus torquatus* (Linnæus); and Philippine oriole, *Oriolus chinensis chinensis* Linn. It even attempted to imitate the call note of the island painted quail, *Excalfactoria chinensis lineata* (Scopoli)! I was impressed by its excellent ability to mimic the notes of other birds and expected it to continue weaving into its song notes of other species, when suddenly it changed into the "tweet-tweet-etc." of a helpless nestling. A casual observer could easily mistake it for one. I approached it and immediately it reverted to the harsh note of the species, "keoo-keoo, keoo-keoo", "cheek-keek, cheek-keek, cheek-keek-keek-keek-etc." Then, "keek-keek-keek-keek-etc."

Both sexes have been observed to sing this song during the latter part of May and throughout the other months of the year in which the species is not burdened with nesting activities.

The bird has the characteristic pugnacity of the shrike group. It exhibits this trait in extreme degree during the nesting season, the parents allowing no bird, large or small, to pass the nesting site without chasing it. They fight with birds of their own as well as of other species.

The species nests rather abundantly in the vicinity under observation during March, April, May, and June. The breeding season begins as early as March and continues throughout the summer months. It reaches its height in April and May. The latest record for eggs of the species was June 11, when a nest with one egg was found.

BREEDING HABITS

COURTSHIP

There is a lot of noise and fighting connected with the courting activities of the species. Pugnacity is clearly manifest at this stage, especially on the part of the male. Two or more males often compete for the favor of one female. One can always tell that the species is in the vicinity by the noise that the birds produce. One male sets up a chase for the female, and very soon the other male or males follow. The chase is on, from bush to bush, then around and ultimately back to the original perch. Throughout the whole activity both sexes keep on filling the air with their harsh shrieks. Now, the female is left alone; the males chase each other and fight savagely, at the same time emitting harsh shrieks. One of them later leaves the vicinity of the female. The other then approaches the female on her perch with a grasshopper, a mantid, a long-horned locust, a beetle, or a cricket. The female, after awhile, accepts the gift. The male has still a lot of trouble ahead because sooner or latter the rival male, which he had chased away, returns to the scene to renew the rivalry. The fight between the males is resumed, and this time the other one may have the advantage, in which case the beaten party has to retire from the scene.

The whole procedure is repeated over and over and in different places wherever the female goes. At intervals the birds feed peacefully, but any sign of activity from any one in which the female is involved, always means a resumption of the battle. This happens repeatedly until about the third day, when the female usually begins to show a preference for one male in many little ways. Very often the male who usually comes out victorious in the fighting is the one preferred. Ultimately the rival male ceases to go along.

The male and female search for food together. Usually they do not go far from the scene of the courting activities. In the top of some bush or tree they can usually be seen perching not far from each other. From there they carry on the feeding activities. Throughout the procedure they move from place to place but not far away. Very likely the couple has been determining the possibility and advisability of each place visited, as a nesting site. It may be several days before the birds agree to stay in a place, and by that time they must have visited many places in the immediate vicinity.

The observer can tell when a couple has decided to stay in a site. The male and female stay in the chosen place and in-

clude an area of about 50 meters' radius as their territory. No bird of the same or other species can pass through this territory without being chased or challenged by either parent. It seems strange, but the smaller species are left alone even though they feed in the territory patrolled by a couple. Thus, the yellow-breasted sunbird, *Leptocoma jugularis jugularis* (Linnæus); golden-headed cisticola, *Cisticola exilis rustica* Wallace; pied chat, *Saxicola caprata caprata* (Linnæus); and Meyen's silvereye, *Zosterops meyeni meyeni* Bonaparte were left alone to pursue their various daily activities in a territory of a pair of large-nosed shrikes which was under close observation. On the other hand, the guava bulbul, *Pycnonotus goiavier goiavier* (Scopoli); Philippine bulbul, *Iole gularis* (Pucheran); striated marsh warbler, *Megalurus palustris forbesi* Bangs; Philippine oriole, *Oriolus chinensis chinensis* Linnæus; barred ground dove, *Geopelia striata* (Linnæus); and Philippine crow, *Corvus coronoides philippinus* Bonaparte were chased away from the territory by either one or both owners.

For several days the couple continues to stay and feed in the territory which it has chosen. Led by the female the two birds keep on transferring their perch from one tree to another within the territory.

At intervals between feedings the male from a perch swoops down on the female near-by, and together both birds fall fluttering and shrieking only to separate and return to their former perches when nearing the ground. This act is repeated from time to time, and no doubt copulation takes place during this period.

As soon as the female has found the right place, nest-building activities begin.

NEST AND NESTING

The nest is typically a fairly substantial cup with rather thick slovenly sides of dried grass stems and leaves, lined inside with fine grass inflorescence stalks and roots. It is moderately compact in structure. On the whole the species is not very careful in trimming the external parts of the nest. Not infrequently the grass stems and leaves project from the sides in a slovenly fashion so as to give one the impression that a pile of dead or dying grass stems and leaves has been dumped on a fork or broad cut end of a stem or branch.

The nest is placed in a variety of sites offering the desired strong support, but on the whole leafy and low trees in the open

or along hedges are preferred. In the majority of nests studied the broad cut ends of branches formed the bottom support, and the small twigs at the sides, the side support. Sometimes a natural forking of the main stem is utilized as a safe place. In all cases there is a thick growth of leaves over and around the nest so that a casual observer will not easily find it. Of twenty-eight fresh nests studied fifteen were found in madre cacao trees, ten in mango trees, one in a young shrub, *Semecarpus cuneiformis* Blco., and two in "baga-babui," *Gmelina philippensis* Cham. Of eighteen old nests observed eleven were found in madre-cacao and seven in mango trees, which the species seems to prefer for nesting sites in the area under observation. The following notes illustrate the nature of the nesting sites:

May 2.—A large-nosed shrike nest at the broad cut end of a trunk of madre cacao planted as hedge. The growing twigs at the tip form a very convenient support for the sides. The heavy growth of leaves forms a canopy over the nest, shielding it from the sun's heat and the rain, at the same time hiding it from enemies. About 1.5 meters from the ground.

Nest in another madre-cacao tree:

May 7.—A large-nosed shrike nest in fork of madre-cacao tree planted as hedge. Well located, each of the forked branches about 6 cm in diameter. A natural hollow between provides a nice and safe place for the nest. The newly growing leaves form an effective cover from enemies, heat, and rain. Two to 2.5 meters from the ground.

Nest in a mango tree:

April 22.—A nest with four eggs in a wind-blown mango tree. Well placed on a branch about 6 cm in diameter, and supporting the sides are smaller twigs with luxuriantly growing leaves. Cleverly placed among the foliage so that it was rather hard to discover were it not for the strange behavior of the mother bird. About 1 meter from the ground.

Nest in another mango tree:

May 6.—A large-nosed shrike nest at the cut end of a mango branch. Tree has been raised and pruned after having fallen during a typhoon. Well hidden among the newly growing leaves congregated at the tips of the cut branches. Cannot be easily detected. About 3 meters from the ground.

The nest is not placed very far from the ground. Of the forty-six nests studied, the height ranged from 0.75 to 3 meters, with an average of 1.7 meters.

Nest building is always associated with utmost industry on the part of both sexes. Although the male seems to do a larger share, the two birds work together in collecting the building

materials. The female does the major part of the actual weaving. This does not mean, however, that each sex limits itself to the particular phase of the work which it usually does. The male, after fetching a grass stem, attempts to weave it into the structure of the nest, but his work is subject to the improving touches of the female. She may remove the material from one place and weave it elsewhere or she may leave it as it is. The female fetches building materials and weaves them into the nest.

The building is a gradual process. The bottom foundations are first laid on the selected site. Not infrequently the new nest is built upon an old one or very near it. In this case the new materials are laid on top of the old nest, the latter serving as a bottom support. When the foundation has been laid, the side structure is woven. The materials, usually consisting of long grass stems and fibers, are cleverly interwoven. A single stem with some of the leaves on may be woven in on one side, coiled around, then to the bottom and out to the other side. In this way the materials at the sides of the nest are strongly interwoven with each other and with the materials at the bottom. A cup-shaped cavity is left at the center.

At first the nest looks unkempt, with the grass ends sticking out from the outside and the leaves coming out from all places. The materials forming the sides are grass stems, sometimes as long as 120 cm. Most of the stems make several coils around the nest, thereby making the structure much stronger than if shorter pieces were used. Next, a layer of grass leaves, grass-leaf bases and sheaths, thin bark of bushes, plant fibers, plant down, and tendrils are interwoven at the bottom of the cavity. This layer forms a mattress over the projecting leaves, branches, and other roughness at the bottom. The birds place the inner layer as the finishing touches to the nest. In this layer only fine materials are used, among the most important of which are fine grass stalks and inflorescences, fibers from grass-leaf bases and sheaths, fine grass roots, fibrous weed bark, and the fine stems of grasses. These materials are carefully coiled around so as to form a cozy lining. The birds require from four to seven days continuous work to finish the nest.

In the outer layer of the nest the following may be used: Stems and leaves of *Paspalum conjugatum* Berg. and of *Cynodon dactylon* (Linn.) Pers.; leaf bases, leaf sheaths, stalks, and inflorescences of *Imperata cylindrica* (Linn.) Beauv. and of *Oryza sativa* Linn.; stalks and inflorescences of *Cyperus rotundus*

Linn.; leaves of *Mangifera indica* Linn.; and fine stems of *Hyptis suaveolens* Poir.

In the inner lining the following may be used: Stalks and inflorescences of *Andropogon aciculatus* Retz., of *Andropogon nitidus* (Vahl) Kunth., and of *Paspalum conjugatum* Berg.; roots, stalks, and inflorescences of *Cynodon dactylon* (Linn.) Pers.; and fibers from leaf bases and sheaths of *Imperata cylindrica* (Linn.) Beauv. and of *Oryza sativa* Linn. Incorporated in the structure of the sides are fine stems of unidentified creepers, hemp strings, and cotton threads.

Measurements of forty-six nests of the species gave the ranges as 80 to 90 mm inside diameter, 115 to 135 mm outside diameter, 50 to 65 mm inside depth, and 95 to 121 mm outside depth.

Egg-laying is begun as soon as the nest is ready. The female remains in the vicinity of the nest and feeds near-by. This is much more noticeable after the first egg has been laid. The egg is usually laid during the first half of the day.

The full complement is normally four, although clutches of three eggs are not uncommon. Of twenty-five nests studied twenty-one, or 84 per cent, contained the full complement of four, and four nests, or 16 per cent, contained three. There is an interval of about twenty-four hours between layings.

EGGS

The egg is broad, blunt, and oval, with one end slightly more pointed than the other. There is very little variation among the eggs. The shell is fine in texture and usually dull. In only few specimens is there an indication of a very faint gloss. The ground color is pure white in newly laid eggs, but greenish or creamy white in old eggs. The three eggs originally described by Oates and Reid (1905) must have been old specimens. In nests in which the full complement has not been laid, the newest egg could be distinguished easily from the eggs laid a day or two previously. The egg is spotted and blotched, especially around the broader end, with rusty or reddish brown with undermarkings of pale lavender, changing with age to lilac in some specimens. There is great variation in the density of the spots and blotches; in some it is very slight and in others, quite heavy. In two specimens examined the blotches tended to form a cap at the broader end.

The eggs vary only slightly in size. Measurements of 96 eggs give the following dimensions: Range in length, 21 to 23.5 mm;

mean, 22.5; breadth, 16 to 18.2 mm; mean, 17.1 mm; minimum size of eggs measured, 21 by 16 mm; maximum size of eggs measured, 23.5 by 17.7 mm and 23 by 18.2 mm; average measurements of 96 eggs, 22.5 by 17.1 mm.

INCUBATION

Of the successful nests studied the eggs were hatched thirteen to sixteen days after the full complement had been laid.

The female stays close to the nest immediately after the completion of the clutch. She feeds in a place close to the nest. The male often stays on a perch near-by and performs the duties of a patrol and a sentry. Off he goes on the chase, shrieking wildly as he flies in order to drive away the daring intruder, be this a bulbul or a fellow large-nosed shrike who dares invade the nesting vicinity. He gives the warning shrieks at the approach of any big creature that is beyond his power to chase away. Upon hearing the warning notes of the male, off goes the female to aid him. The couple, then, proceeds to lead the intruder away from the nesting site by various antics, which are very interesting to observe.

The female begins sitting immediately after the full complement is laid, although the serious business of incubation really begins two to three days after the last egg is laid. During this period the female sits day and night. Observations made at night on several nests showed that prior to this time the female does not sit at night, although both parents have been flushed from the nest tree or very near it. From this time until the eggs are hatched, the female sits very close, rarely leaving the nest unless disturbed. The male brings her the insect food that she needs. Starting from the seventh or eighth day of incubation, even in the presence of a disturbing influence, the female is reluctant to leave her eggs, unless she is approached dangerously near. Only the female does the incubating.

Normally, unless disturbed, the full complement hatches. However, when tampered with, taken from the nest or held in the hand, the eggs do not hatch. Of fourteen nests containing full sets, two nests did not give 100 per cent hatching. In one nest the writer held one egg to the light and in the other, he held two of four eggs when measuring them. In these two nests alone were failures in hatching observed. In the twelve other nests the percentage of hatching was 100.

YOUNG

Description of nestlings.—The nestlings of different ages present a variety of characteristic features which change gradually as they grow older.

First day:
- Nestlings naked, tiny and helpless.
- Skin semitransparent and very red.
- Eyes closed but dimly visible through skin.
- Heads seemingly too big for the tiny bodies.
- Movements hardly discernible.

Second day:
- Size increased to about twice the original.
- Skin becomes dark and begins to thicken.
- Movements more discernible.

Fourth day:
- Size increased four times the original.
- Skin acquired fully a dark color in the pterylæ.
- Eyes open and very tiny.
- Wings with erupting bristlelike feathers.

Sixth day:
- Size continues to increase.
- Whole body appears bristly due to erupting feathers.

Eighth day:
- Size continues to increase.
- Bodies clothed with feathers although incompletely.
- Wing feathers longest and most developed.
- Tail feathers begin to develop as a tuft on the uropygium.
- Eyes appear normal in size.
- Heads more in proportion to body size.

Tenth day:
- Size continues to increase.
- Plumage more complete although apteria are still visible in some places.
- Wing feathers open along entire exposed length.
- Tail feathers open but very short.
- More conscious protective reactions.

Twelfth day:
- Size about that of adult.
- Plumage more complete but apteria on ventral surface still visible.
- Longest tail feathers about 10 mm in length.
- Yellow gape and buccal lining very striking.

Fourteenth day:
- Plumage more complete but apteria on ventral surface still visible in some few places.
- Longest tail feathers about 15 mm in length.
- More conscious protective reactions.

Sixteenth day:
Young capable of flight although not long sustained.
Plumage complete.
Longest tail feathers 20 mm in length.
Capable of taking care of themselves by more purposive protective reactions.

The young are ready to leave the nest in seventeen to nineteen days after hatching. They may take flight after the fourteenth day, especially when danger threatens. In such a case, however, the young have the minimum chance to survive as they are not yet fully equipped. Observations on five nests gave the range as seventeen to nineteen days before the young were fully able to leave the nest voluntarily. In two nests the young left in seventeen days after hatching; in two others they left in eighteen days, and in one nest in nineteen days.

Care of young.—Immediately after the hatching of the eggs, the parents begin to work harder. During the first six days the mother stays very often in the nest, perhaps in order to shelter the nestlings who, up to this time, are devoid of feathers. The responsibility of procuring food for the nestlings during this time rests mainly on the male, although the female also goes out at times and procures food for them near-by. As soon as the young have grown enough feathers, the search for food is performed by both parents. They take turns in going out, being always careful that one of them is left in or near the nest. During this stage the territorial rights are very well upheld. The parents are always ready to chase any other large-nosed shrike that may happen to hunt for food within the bounds of the territory. As a result much fighting takes place, and in no other period is the species more quarrelsome, more pugnacious, or more noisy. Every intruder is heralded by the harsh warning notes of the parent that first happens to notice the approaching danger.

The following notes illustrate the behavior of the parents when the nestlings are actually intruded upon, in the nest. In this case the nest was in a pruned mango tree about 3 meters from the ground and the nestlings were two days old.

May 26.—The female stayed in the nest until approached dangerously near when she flew to a near-by dead and storm-blown mango tree. The male immediately came and perched near the female close to the nest tree. He kept on protesting. The female was very vehement in her protests. She kept on having her feathers fluffed up and ruffled so she would look very sickly and weak. Then with the head pointed down, she commenced to fall from the topmost branches of the dead tree, vertically from limb

to limb, each drop about 30 cm from the previous perch. She effectively simulated a very weak bird and at first sight an observer would think she was really falling from sheer weakness. The male followed suit and for about five minutes both birds kept it up, beginning from the topmost branches and falling until within about 60 cm of the ground.

Upon coming down from the nest tree I observed the male flying weakly away to a near-by tree about 3 meters farther. The female soon followed, fluttering weakly away. She made a detour and perched on the nest tree but on the other side of the nest. The male kept on fluttering weakly from tree to tree until I was led about 100 meters away from the nest tree, when with rapid beats of the wings he made a detour and perched on top of a mango tree, at the same time uttering harsh complaining notes. When left alone at last, he continued on his hunt for food.

The nestlings are always on the alert for the parental warning notes. Immediately upon hearing them they lie low and remain motionless at the bottom of the nest. The same reaction has been observed in all nestlings of different stages.

If caught standing the older nestlings maintain the same position and remain motionless until such time as they deem it wise to move and go back into the nests, there to lie low. In several instances older nestlings were surprised standing on the rim of the nest, among the twigs, with the mouth wide open. The same reaction has been observed in younger nestlings with the eyes already open. In connection with this remarkable phenomenon it is well to note that the open mouth presents a frightening spectacle because of its bright yellow interior and borders. The sight can easily frighten nervous intruders away, and in this way helps in the preservation of the individual.

Upon leaving the nest the young birds are led by the parents to some particular bush or tree, often in the nesting territory, which the older birds, perhaps, consider a safe shelter for them. The parents continue procuring food for the the young ones, although by this time the young must have begun receiving their instructions from the parents regarding food-getting. When a family is approached closely, the parent birds do a great deal of shrieking. One of them, most likely the male, usually approaches the intruder with initial warning notes resembling the syllables "keoo-keoo-etc.," repeated several times. These are followed by another set of notes resembling the syllables "cheek-keek, cheek-keek, etc.," also repeated several times. The bird then flies to a near-by tree but farther from the young, all the while shrieking wildly. The notes are different, this time resembling the syllables "cheek—keek–keek, etc." These notes are repeated over and over again as long as the intruder is in

the vicinity. The other parent follows later, perhaps after having made sure that the young ones are safely hiding, also making a lot of noise. They keep this up, all the time flying farther and farther away from the hiding place of the young ones. Upon seeing that the danger is past, one of the birds, most likely the female, stops shrieking and flies in a roundabout way, back to the young. The other keeps on scolding, but later follows as soon as everything is well.

The young birds stay close to their parents as much as possible. Upon hearing the warning notes of either parent they proceed to hide themselves in places where they are least likely to be seen. Several young birds were observed to stay in the thick growth of leaves at the ends of the cut branches of a pruned mango tree. They stayed there and remained motionless until all was quiet, and then flew away with the parents to another tree.

The young birds continue to accompany their parents until they are old enough and are fully able to take care of themselves. Young birds with tail feathers about 11 cm long, calculated to be about ten weeks old, have been commonly observed feeding in the company of adult couples, which in all probability were the parents.

PREDATORS

The large-nosed shrike, like other species of birds, is subjected to an immense number of factors that tend to control its number within reasonable limits so as to maintain the normal biological balance. Among the most important of these factors is the presence of predators preying on the eggs, the young, and even the adults of the species.

Twenty-eight nests were under close study throughout the period of observation. In only six nests were nestlings successfully reared until they were able to fly. This means that only 21 per cent of the possible number of sets of nestlings were able to leave the nest unharmed. It does not mean that this number of successful nestlings will remain so until they become adult. Immediately after the young leave the nest, the same dangers confront them and may cut their number to a still lower percentage. Ultimately, only a small fraction of the young hatched reach maturity.

Twenty-six nests of the original twenty-eight under observation contained the full complement of eggs. Two nests were robbed of their contents before the sets were complete. In one nest there were only two eggs when it was robbed; in the other,

only the first egg was ever laid. Eleven nests of the original twenty-six that contained the full complement of eggs were robbed of their eggs, leaving only fifteen nests with eggs to hatch. This leaves only 58 per cent of the original number of sets to be hatched. Eight of the fifteen nests that contained nestlings were robbed of these nestlings at different stages of development, but in all cases still incapable of flight. Thus, only 40 per cent of the sets of eggs hatched lived to the time of flight from the nest. Consequently, the owners of only six nests, or 21 per cent, of the twenty-eight nests studied were successful in rearing the young to the time they were capable of leaving the nest.

Predators that are observed to roam the vicinity are the crow, *Corvus coronoides philippinus* Bonaparte; the monitor lizard, *Varanus salvator* (Laurenti); and the civet cat, *Paradoxurus philippinensis* Jourdan. Perhaps there are still others.

Crows were frequently observed feeding within the area of observation, and they were held mainly responsible for the immense number of missing eggs. In several instances, flocks of ten or twelve were observed alighting in a vicinity. After they were gone, nests in that particular vicinity were frequently found to have been robbed.

Monitor lizards, large and small, have been observed to abound in the vicinity. Many have been shot or procured with dogs. A monitor lizard of medium size was observed to leave a nest tree, and the writer fearing for the safety of the nestlings under study immediately went to the nest. Not a trace of the nestlings was left.

Civet cats have been caught many times by the farmers in the vicinity. In several instances nests observed to contain nestlings late in the afternoon were found to have been robbed of their live contents early the next morning. There is only one probable explanation of this phenomenon; a predator had visited the nests sometime in the evening and deprived them of their contents, possibly even including the brooding mother.

In all likelihood there are other predators roaming around in the area under observation, but the toll exacted by these three creatures is enough to give an idea of the cause of the excessively high rate of mortality in the species.

SUMMARY AND CONCLUSIONS

1. Studies on the breeding habits of the large-nosed shrike, *Lanius schach nasutus* (Scopoli), were made in the vicinity of

Novaliches, Rizal Province, Luzon, within an area of about 8 square kilometers.

2. The species breeds during March, April, May, and June. Nesting reaches its highest in April and May.

3. Courtship is replete with fighting and noise; at no other time is the species more pugnacious, quarrelsome, and noisy.

4. The nests are cup-shaped and made mostly of grass. Stems, leaves, stalks, and inflorescences, mango leaves, and other plant materials are woven into a cup with thick sides. Forty-six nests gave as average measurements, 128 mm outside diameter, 82 mm inside diameter, 57 mm inside depth, and 102 mm outside depth.

5. The nests were frequently found in madre cacao, *Gliricidia sepium* (Jacq.) Steud., and mango trees, *Mangifera indica* Linn. This shrike places the nest preferably in low leafy trees in the open or along hedges.

6. The egg, a broad blunt oval with one end slightly more pointed than the other, possesses a greenish or creamy white ground color with little or no gloss. It is spotted and blotched, especially around the larger end, with rusty or reddish brown, with undermarkings of pale lavender changing to lilac. The average measurements are 22.5 mm by 17.1 mm.

7. The full complement of eggs is normally four, observed in 84 per cent of the nests studied, although sets of three eggs are not rare, represented by 16 per cent of the nests studied.

8. There is an interval of one day between layings, and the eggs are laid during the first half of the day.

9. Incubation takes from thirteen to sixteen days and is performed solely by the female.

10. The young leave the nest in from seventeen to nineteen days after hatching, although at times they may leave as early as the fourteenth day.

11. The young go with the parents even until they have about acquired the adult plumage.

12. Predators, such as crows, *Corvus coronoides philippinus* Bonaparte; monitor lizards, *Varanus salvator* (Laurenti); and civet cats, *Paradoxurus philippinensis* Jourdan, destroy many eggs, nestlings, young birds, and adults.

13. Twenty-eight fresh nests were under close observation. Only six sets of eggs in six nests, of the original twenty-eight, were hatched and reared to the time the young were voluntarily able to leave the nest. Only 21 per cent of the original sets were reared successfully.

LITERATURE CITED

1. McGregor, Richard C. A Manual of Philippine Birds, pt. 2. Manila (1909) XI–XVI, 413–769.
2. Oates, Eugene W., and S. G. Reid. Catalogue of the Collection of Birds' Eggs in the British Museum (Natural History). London 4 (1905) XVIII + 352 pp., 14 pls.
3. Whitehead, John. Field notes on birds collected in the Philippine Islands in 1893–6. Part II. Ibis 5 (1899) 226.

ILLUSTRATION

PLATE 1. Nestling large-nosed shrike, *Lanius schach nasutus* (Scopoli), in the nest.

355

PLATE 1.

NOTES ON FISHES IN THE ZOÖLOGICAL MUSEUM OF STANFORD UNIVERSITY, V

NEW OR RARE PHILIPPINE FISHES FROM THE HERRE 1933 PHILIPPINE EXPEDITION

By Albert W. C. T. Herre

Of Stanford University, California

TWO PLATES

Continuing the account of new or rare fishes in the Stanford University Museum collected by me during the past five years, I herewith present seven new species, one new genus, and distributional notes upon a number of rare species, most of them hitherto unknown from the Philippines. Part of November and most of December, 1933, were spent in the Philippines. Stops were made at Davao, Zamboanga, Dumaguete, Cebu, Iloilo, and Manila in the order named. No intensive collecting was done except at Dumaguete, Bais, Oriental Negros, and at Opon, Mactan Island.

The fact that new and distinctive species were obtained at Dumaguete, where I have been working the tide pools at every opportunity for the past sixteen years, speaks volumes for the incredible richness and variety of Philippine fish life. There is no doubt that intensive collecting would yield equally good returns at many points along the coasts of Luzon. Taking a blenny at Paraoir, La Union Province, that was only known from specimens collected in Java nearly eighty years ago, is sufficient proof of my statement.

Evidence is constantly accumulating that many shore fishes as yet known only from the Philippines are widely distributed in the China Sea; if not already known there, they are to be looked for at Hainan, along the coast of Indo-China, and on the shores of the Malay Peninsula and Singapore. In the same way, many more fishes hitherto known only from the Moluccas, Sunda Islands, and even from the far distant Hawaiian Islands, will eventually be found in the Philippines.

In spite of the great number of gobies already reported from the Philippines, the evidence points to the conclusion that many more gobies are to be discovered in Philippine waters. This

is particularly true of certain regions; large collections should be made in brackish waters, in estuaries, and on mud flats exposed at low tide, as well as in tide pools. Nothing has been done as yet towards collecting gobies below low tide, in water from one to eight meters deep. A rich harvest awaits anyone who uses a diving helmet for collecting gobies. Much of what has just been said applies equally to the blennies, which have been but little collected. They are very difficult to catch, but patience and skill will get them.

Other groups meriting special attention are the sharks and rays, catfishes, eels, Sparidæ, and Sciænidæ, all of them of much commercial importance and very incompletely known from Philippine waters.

Types of new species are in the Stanford University Museum, and paratypes in the Bureau of Science collection where material allows.

OPHICHTHYIDÆ

CÆCULA PHILIPPINENSIS sp. nov. Plate 1, fig. 1.

The depth is 38.4, the head 12.166 times in the length; the head is 5.6 in the trunk, which is more than 2.5 times in the total; the tail is longer than the head and trunk together, their length being about 47 per cent of the tail. The eye is 17.3 times in the head, 3 in the very slender, sharp-pointed snout, which is nearly 5.8 times in the head; the gape is $4\frac{1}{3}$ times in the head; the gill openings are unequal in size and position, the right one being anterior to and about 3 times as large as the posterior left one. The dorsal origin is almost over the left gill openings, the distance between being 13 times in the head. The fins are low, of equal height or the anal a trifle higher, their height about 6.5 times in the head. There are vomerine teeth in a single row, smaller than the single row of teeth in the jaws; on the intermaxillary plate are 3 larger teeth.

Color in alcohol uniform brown above, merging into violaceous brown beneath.

The type and only specimen, 365 mm long, was taken at Dumaguete, Negros.

SYNGNATHIDÆ

SYNGNATHUS MARTINI sp. nov. Plate 1, fig. 2.

Dorsal 37; pectoral 13; caudal 10; anal 4; rings 19+39; subdorsal rings 5+5.

The depth is 28 in the length, $3\frac{1}{3}$ times in the head, and 8 in the trunk, equal to the caudal; in the figure the artist has in-

cluded the open and expanded brood pouch, thus increasing the apparent depth beyond its true ratio; the head is 8.4 times in the length, 2.4 in the trunk, and 5 in the tail; the trunk is a little more than twice in the tail and the head and trunk together are 1.47 times in the tail; the dorsal base is a little longer than the head. The eye is 6.66 times in the head, twice in the caudal; the snout twice in the head. The egg pouch is on the last trunk and 17 tail rings, and is $^{15}/_{16}$ of the trunk length or 2.2 times in the tail; it is partly filled with embryos, and is much dilated.

Body very elongate, trunk heptagonal, tail 4-sided except along the egg pouch where it is hexagonal; the smooth shields are transversely striated; the superior cristæ of trunk and tail are discontinuous, the inferior cristæ continuous; the lateral median trunk cristæ end at the hind edge of the last trunk ring, the superior cristæ of the tail beginning above, in middle of the last trunk ring.

The snout has a smooth sharp median keel reaching to the concave interorbital; a pair of low smooth lateral ridges extend to the prominent orbital ridges and slightly beyond. At the hind end of the interorbital is a smooth median ridge, followed by another smooth median ridge on the nape, terminating above the pectoral base. The operculum has a very small straight keel on its anterior fourth, with very many minute radiating reticulating ridges.

The color in alcohol is brown, with darker brown crossbands.

Described from the type and only specimen, 168 mm long, from Manila Bay. Though close to *S. acus*, the dorsal position is very different. It is still closer to *S. yoshi*, from which it differs in several particulars.

I take pleasure in naming it for Mr. Claro Martin, of the Philippine Fish and Game Administration, who is an earnest worker on the Philippine fish fauna.

GOBIIDÆ

VAIMOSA MONTALBANI sp. nov. Plate 1, fig. 3.

Dorsal VI–1, 7; anal I, 6 or 7; there are 6 predorsal scales in males, 7 in females, 7 in a tranverse series, and 24 or 25 in a longitudinal series, plus 1 or 2 on the caudal base.

Males have a stout body with strongly arched back, the depth 3.5 to 3.65, the head 2.75 to 3.3, the caudal 3 to 3.5 times in the length; the eye is in the anterior half of the head, 3.25 to 3.5, the snout 4.5 to 4.66, the maxillary 1.8 to 2.2, the least depth of the caudal peduncle 2.8 times in the head. The elon-

gated and threadlike first dorsal spine extends upon the second dorsal, sometimes reaching its posterior extremity, 2.5 to 4.5 times in the length; the second dorsal and anal rarely extend to the caudal base when depressed, 1.7 to 2 times, the pectoral 1.4 to 1.5 times in the head; the ventrals extend to the anal origin or beyond, 1.3 to 1.4 times in the head.

Females do not have the back elevated, the low first dorsal does not reach the second dorsal when depressed, the ventrals are shorter, and the second dorsal and anal are noticeably lower than in males.

A female 18 mm long has the depth 3.6, the head 2.8, the caudal 3.6 times in the length; the eye is in the anterior half of the head. The snout is 4, the eye 3.2, the maxillary 3.2, the pectoral and ventral each 1.6 times in the head.

In males the large maxillary extends below the posterior part of the eye or beyond, in some almost to the rear angle of the preopercle. In females the mouth is much smaller, the maxillary extending to the eye or beneath its anterior half.

Males are pale yellowish brown in alcohol, with dark brown spots and scales sprinkled over the upper half; there are a dark brown spot at the upper angle of the opercle, 4 dark brown spots in a row along the middle of the side, a large blackish brown spot at the caudal base (often with a pale center), and a row of black spots under the anal and caudal peduncle; behind the pectoral is a dark brown vertical bar, and a similar bar crosses the belly over the anus; the sides of the head are mottled with yellowish and dusky brown; the first dorsal is deep black above and posteriorly, with a dusky basal crossbar and two black spots on the anterior margin, the rest of the fin clear; the soft dorsal and caudal each have two or three dusky brown crossbars; the anal and the ventral membranes are dusky, the pectorals clear.

Females are similarly marked, but are very much paler, their markings nearly disappearing.

Here described from the type, 20 mm long, and 35 paratypes, 14 to 23 mm long, from Lake Naujan, Mindoro.

This little goby is close to *Vaimosa dispar* Peters, but differs markedly in scalation and color markings, and the elongated first dorsal spine. It agrees with *V. dispar* in the large mouth and elongated maxillary of males, and in the males being larger than females.

I take pleasure in naming this goby for Mr. H. R. Montalban, who was my associate in an exploration of Lake Naujan.

CTENOGOBIUS VILLADOLIDI sp. nov. Plate 2, fig. 4.

Dorsal I, 12; anal I, 12 or 13; scales in longitudinal series 27 or 28 plus 1 on the caudal base and 8 in transverse series; predorsal none.

The depth is 6.4 to 6.7, the head 3.4 to 3.5, the caudal 4.14 to 4.4, the pectoral 3.9, the ventral 3.6 to 3.9 times in the length; the eye is 3.9 to 4.1, the snout 5 to 5.5, the maxillary 3.3 to 3.5, the least depth of the caudal peduncle 4.1 to 4.3 times in the head.

The body is slender, elongate, the breadth greater than the depth, wedge-shaped viewed from above, with pointed head, the breadth of the head 1.45 to 1.5 in its length; the prominent dorsolateral eyes project above the dorsal profile, are longer than the steeply descending snout, and meet or nearly meet at their inner margins; the mouth is oblique with projecting lower jaw, the maxillary angle beneath the front margin of the pupil; the teeth are minute, no canines; the tongue is rounded to truncate, the head is entirely naked, without scales above the opercles; the breast is naked, the rest of the body covered with large ctenoid scales of uniform size, their cilia very minute. The first dorsal barely reaches the second dorsal when depressed, both dorsals of the same height, 2.1 to 2.3 in the head; the anal is a little lower, 2.9 to 3 in the head; the slender, round-pointed caudal shorter than the head; the broad, well-developed ventrals extend to or beyond the anal origin.

The color in alcohol is whitish with blackish scale margins on the upper half, some of them on the sides enlarged to form a row of five black spots, the last on the caudal base; the entire head and body are more or less thickly sprinkled with black specks; the first dorsal is sprinkled with black dots and white or clear spots, and in males also has one to three large elongated black spots along the fourth or third, fourth, and fifth spines; the second dorsal is densely sprinkled with black dots, often with a clear margin; the anal has a broad black longitudinal band, the tips of the rays white; the caudal is barred by several rows of black spots, the tip black with a white margin; a black bar on the upper part of the pectoral base, the fin clear or specked with black; the ventrals are black with a broad white margin or may be colorless.

Described from the type, 31 mm long, and 14 paratypes, 17 to 31 mm long, collected from a tide pool near Dumaguete, Oriental Negros.

This species is close to *Ctenogobius nuchipunctatus* but differs in many respects.

I take pleasure in naming it in honor of Dr. Deogracias Villadolid, student of Philippine fishes for many years, to whom I am indebted for much valuable assistance.

SCHISMATOGOBIUS ROXASI sp. nov. Plate 2, fig. 5.

Dorsal VI–I, 9; anal I, 8; no scales.

The depth of the naked, robust, well-rounded body is contained 5 times, the caudal, pectoral, and ventral each 4.4 times in the length. The large, broad, flattened head is 2.75 times in the length, its breadth 1.75 times in its own length. The small eye is 8 times in the head, twice in the bluntly pointed snout; the flat interorbital is 6.4 times in the head; the postorbital region is 1.8 times in the head or one and two-thirds times the eye and snout together. The large mouth is oblique, its angle beneath the front of the pupil, but the maxillary is greatly widened and lengthened and reaches almost to the angle of the preopercle, its length equal to that of the caudal or to the postorbital part of the head, 1.6 times in the head; the tongue is notched; the small teeth are in bands of 5 or 6 rows in both jaws. The dorsals and anal are all low; the first dorsal height is 3.7, the second dorsal 2.46, and the anal height 2.66 times in the head.

The color in alcohol is brown to yellowish brown, mottled with irregular flecks and streaks of blackish, and with three dark brown dorsal crossbands, the first beneath the first dorsal, the second under the middle of the second dorsal, and a third narrower one on the caudal peduncle. Both dorsals, the caudal, and pectorals are crossbarred by rows of black spots; the ventral rays are colorless, but the membranes between are black with a mass of dusky spots; the ventrals are colorless.

Described from the type and only specimen, 44 mm long, from San Jose, Antique Province, Panay. It is close to *Gobiosoma insignum*, but differs in the extraordinary development of the maxillary. From *Schismatogobius* as defined by de Beaufort it differs markedly in the character of the teeth, and I am therefore uncertain as to its exact generic position.

I am pleased to name this in honor of Dr. Hilario A. Roxas, chief of the Philippine Fish and Game Administration, who is devoting his energies to studying the greatest natural food resource of the Philippines, the fishes of the Philippines waters.

MARS HAYDENI sp. nov. Plate 2, fig. 6.

Dorsal VI–I, 12; anal I, 12; about 65 scales in a longitudinal series.

The body is slender, with nearly horizontal dorsal and ventral profiles, the depth 6, the head and rounded caudal each 3.55, the pectoral 4.5, the ventral 5.3 times in the length. The eye is in the anterior half of the head, equal to the convex blunt snout, 4.5 times in the head; the eyes are very close together, their inner margins touching, very high up, dorsolateral; the mouth is oblique, the maxillary extending beneath the anterior part of the pupil, 3 times in the head; the upper jaw has an outer row of enlarged teeth, and behind it a band of four rows of minute teeth; there is a similar band in the lower jaw with an outer row of much larger teeth ending in a small lateral canine on each side; the vomer has two broad teeth; the cheek is margined by sensory papillæ and has two longitudinal rows also, while the opercle has two perpendicular and some marginal rows. A low median ridge extends from the first dorsal to the interorbital. The scales are ctenoid posteriorly, becoming much smaller above the pectoral but not extending forward beyond the hind margin of the opercle, where they are apparently cycloid; the head, pectoral base, and breast naked.

The fins are low, the third dorsal spine 6 times in the length or 1.63 in the head; the penultimate second dorsal ray 2.25 in the head, the anal scarcely as high; the least depth of the caudal peduncle 2.6 in the head; the ventral reaches to the anus, the pectoral a little beyond the ventral tip.

The color in alcohol is pale olive-brown with nine darker crossbands across the back and down the sides, the first two over the head and nape, the next two under the first dorsal, the four following under the second dorsal, and the last on the caudal peduncle; the sides of the head and anterior half of the body are sprinkled with circular black or dark brown dots; the caudal is crossed by several broad dark bands on its basal half, the outer and upper portion barred by rows of black dots; the whitish first dorsal has two longitudinal dark brown bands; the whitish second dorsal has a basal dark band, and two longitudinal rows of elongate black spots on its middle and upper portions; the anal and ventrals are uniformly blackish; the clear pectoral is a little dusky basally.

Described from the type and only specimen, 32 mm long, which I caught on the tide flats at Bais, Oriental Negros. From the

other members of *Mars* this species differs in its fins, poorer development of sensory papillæ and vomerine teeth, and in its occipital ridge.

I take pleasure in naming this species after Dr. J. Ralston Hayden, of the University of Michigan and formerly Vice Governor General of the Philippine Islands, in recognition of his knowledge and appreciation of all phases of Philippine life.

BLENNIIDÆ

SALARIAS FOWLERI sp. nov. Plate 2, fig. 7.

Dorsal XII, 19 or 20; anal II, 20. Minute simple nasal, orbital, and nape tentacles present, or any one or two pairs may be absent; no occipital crest, and no canines.

The depth is 6 to 6.2, the head 4.8 to 5.1, the pectoral 4 to 4.4, the ventral 7.75 to 8 times in the length.

The eye, snout, and least depth of the caudal peduncle each 3 times in the head. The body is elongate compressed, with bluntly rounded head, which is broader than deep; the anterior profile is nearly vertical, the mouth slightly projecting, the maxillary extending beneath the posterior portion of the prominent eye. The dorsal is moderately notched, of nearly uniform height, 2 in the head, the anal 3 times. The dorsal and anal do not extend to the caudal and are free.

The color in alcohol is whitish, with seven brown spots along the middle of the side, each spot containing three or more conspicuous black dots; between the spots are dots and specks, and along the lower side is a row of prominent black dots; rather faint brown dorsal bands composed of minute dots are opposite the lateral spots; the head and upper anterior half are more or less covered with minute brown specks. There are three or four rows of black dots on the dorsal rays, the intervening portions white, the membrane clear; nine or ten black dots are beneath the anal which is clear with a black submarginal band and a white margin; the caudal has four black crossbars.

Described from the type, 31 mm long, and 9 paratypes, 16 to 28 mm long, taken from a tide pool at Dumaguete, Oriental Negros.

I take pleasure in naming this pretty blenny for Henry W. Fowler, who has made notable contributions to our knowledge of Philippine fishes.

ANGUILLIDÆ

ANGUILLA SPENGELI M. Weber.

A number of elvers, 60 to 80 mm in length, seem to be this species. They were taken from a brook at the San Ramon Penal Colony, Zamboanga, Mindanao.

MYRIDÆ

MURÆNICHTHYS SIBOGÆ Weber and de Beaufort.

A specimen of this very rare eel, 102 mm long, was caught at Dumaguete, Negros. It is a small species hitherto known only from the Dutch East Indies. A specimen 103 mm long, taken by the Siboga Expedition, was fully mature.

OPHICHTHYIDÆ

CIRRHIMURÆNA OLIVERI (Seale).

Four young specimens, 70 to 88 mm long, were taken on Pasay Beach, Manila Bay. Previously known only from the type, 380 mm long, from Zamboanga, Mindanao, and a specimen 500 mm long from Tablas.

CLUPEIDÆ

ALOSA PLATYGASTER (Günther).

A specimen 55 mm long, from the southern coast of Tayabas Province, Luzon, agrees with the description by Weber and de Beaufort. New to the Philippines.

MUGILIDÆ

MUGIL STRONGYLOCEPHALUS Richardson.

Two specimens, 102 and 110 mm in length, agree with specimens I collected in Kwangtung Province, China. New to the Philippines, and previously known only from the southern coast of China.

GEMPYLIDÆ

RUVETTUS PRETIOSUS Cocco.

New to the Philippines. Three specimens of the singular oilfish were seen, caught on the Pacific coast of Camarines Norte Province, Luzon. I was able to get but one, 620 mm long. A much larger specimen had been cut up for food, and the third specimen was in such condition as to be useless for scientific purposes.

This circumtropical deep-sea fish is readily recognized by its large eyes, large mouth filled with sharp teeth, its very rough scales, black color, and oiliness. After several years in alcohol specimens still cover one's hands with oil when handled. Specimens long preserved gradually change to uniform brown, losing their original black color.

The oilfish is the object of a remarkable long-line fishery throughout Polynesia and Melanesia. It reaches a length of at least 3 meters, and is caught off-shore in the open sea at depths of 100 to 800 meters or more. It is taken on dark nights, when there is no moon and the sea is perfectly calm. The flesh is very toothsome, but is very rich in an oil that has an extraordinary and exceedingly rapid purgative effect when eaten.

LEIOGNATHIDÆ

LEIOGNATHUS BREVIROSTRIS (Cuvier and Valenciennes).

New to the Philippines. Five specimens, 66 to 80 mm in length, were dredged from Manila Bay. There are no scales on the breast, and in other respects the specimens agree with Weber and de Beaufort's description.

LEIOGNATHUS LINEOLATUS (Cuvier and Valenciennes).

Two small examples, each 51 mm long, were obtained at Iloilo, Panay. New to the Philippines.

SERRANIDÆ

ANTHIAS HUCHTI Bleeker.

A typical example, 48 mm long, was taken from a Dumaguete, Negros, tide pool. New to the Philippines.

POMADASYIDÆ

Genus LUZONICHTHYS novum

Fowler described and figured a fish which he called *Mirolabrichthys waitei.*[1] The chief characteristic of the genus *Mirolabrichthys* Herre is the proboscislike, fleshy, pointed papilla on the tip of the snout. This flexible pointed tip is entirely lacking in *Mirolabrichthys waitei* Fowler, and it also differs in some other particulars, lacking filaments on the ventrals and having the jaws even. I therefore propose the name *Luzonichthys,* with *Luzonichthys waitei* (Fowler) as its type.

[1] U. S. Nat. Mus. Bull. 100 11 (1931) 228.

LUZONICHTHYS WAITEI (Fowler).

A typical specimen, 47 mm long, was collected at Dumaguete, Negros.

SPARIDÆ

NEMIPTERUS TAMBULOIDES Bleeker.

A specimen from the southern coast of Luzon, 109 mm long, seems to belong here. New to the Philippines.

SCIÆNIDÆ

OTOLITHES ORIENTALIS Seale.

This species is well represented by two specimens from Manila Bay, 94 and 140 mm long. Previously known only from the type, 235 mm long, from Sandakan, British North Borneo.

CIRRHITIDÆ

CIRRHITUS MARMORATUS (Lacépède).

A fine example of this wide-spread Indo-Pacific species, 125 mm long, from the coast of Batangas, Luzon. New to the Philippines.

SCORPÆNIDÆ

MINOUS TRACHYCEPHALUS Bleeker.

An excellent example, 53 mm long, was obtained from Subic Bay, Luzon. Bleeker had but 8 specimens, 49 to 80 mm in length, from the Dutch East Indies. New to the Philippines.

PLATYCEPHALIDÆ

ROGADIUS POLYODON (Bleeker).

A young specimen, 51 mm long, from Batangas Bay, Luzon, belongs here, corresponding in detail to Bleeker's description and figure. New to the Philippines. Bleeker had but 4 specimens, 118 to 180 mm long, from Java, Celebes, Ceram, and Amboina.

ELEOTRIDÆ

HYPSELEOTRIS BIPARTITA Herre.

Hypseleotris bipartita HERRE, Gobies of the Philippines (1927) 39, pl. 3, fig. 1.

A fine adult specimen, 37 mm long, and 25 juvenile examples, from 14 to 20 mm in length, from San Agustin River, a tributary of Lake Naujan, Mindoro. This easily recognized little eleotrid has been collected previously only in Albay Province, Luzon.

PARVIPARMA STRAMINEA Herre.

Parviparma straminea HERRE, Gobies of the Philippines (1927) 82, pl. 6, fig. 2.

This very rare eleotrid, hitherto known only from the type, 65 mm long, from Saug River, southern coast of Cotabato Province, Mindanao, is represented by an elegant specimen, 85 mm long, from Aparri, Luzon.

The depth is 7 times, the head and caudal each 4.7, the pectoral and ventral each 7 times in the length; the width of the head is 1.5 times in its own length. The eye is 9 times in the head and twice in the snout; the interorbital and snout are equal, 3.6 times in the head. The other characters are as given in my original description.

GOBIIDÆ

HERREA PRODUCTA (Herre).

Galera producta HERRE, Gobies of the Philippines (1927) 104, pl. 7, fig. 3.[3]

This unique goby was described from the type and only specimen, 49 mm long, from Puerto Galera, Mindoro. From a Dumaguete tide pool I collected 3 fine examples, 52 to 66 mm in length. They are plumper than the type, which was much shriveled by strong preservative.

The depth is 6.5 to 7.4 times, the caudal 2 to 2.36, the head 4 to 4.7, the pectoral 3, the ventral 5 times in the length. The eye is 4 to 4.33, the snout 4 times in the head; the interorbital is twice in the eye. The second dorsal and anal rays are much elongated posteriorly, 1.5 times as high as the anterior or middle rays, and nearly equal to the head.

The color in alcohol is yellowish, densely sprinkled with dark brown, which becomes a uniform coat above; from the eyes a blackish band extends above the opercles to the pectoral angle and curves up to the dorsal origin to meet its fellow from the other eye; beneath the first dorsal a blackish band extends downward and forward to the abdomen; a similar band extends downward and backward from the middle or posterior part of the second dorsal to the posterior rays of the anal; a vertical blackish band on the caudal base; the caudal is black or blackish, the other fins all crossbarred by many rows of dark brown spots or blotches.

[3] *Herrea* Whitley, Australian Zoölogist 6 (1930) 123, replaces *Galera* Herre, preoccupied for a genus of mammals, see Gray, Contributions, British Museum (1842).

GLADIOGOBIUS ENSIFER Herre.

Gladiogobius ensifer HERRE, Copeia (April, 1933) 23.

By far the best specimen of this unique goby seen was taken on the tide flats at Bais, Oriental Negros. It is the largest one yet collected, its length 40 mm; its proportions do not differ materially from those published. It has a low but conspicuous occipital crest from the eyes to the dorsal origin. The color markings are as given in the original account.

OLIGOLEPIS MOLOANUS (Herre).

Aparrius moloanus HERRE, Gobies of the Philippines (1927) 207, pl. 16, fig. 3.

An example 37 mm long from the mud flats at Opon, Mactan Island, establishes a new Philippine record. Hitherto it has been taken in the Islands only in Iloilo and Antique Provinces, Panay.

Dr. Hugh M. Smith obtained 8 specimens, 55 to 66 mm long, in the estuary of Chantaban River, southeastern Siam. This greatly extends the range of the species and is in line with the recent discovery in Singapore and the Malay Peninsula of other gobies previously known only from the Philippines.

APOCRYPTODON SEALEI Herre.

Apocryptodon sealei HERRE, Gobies of the Philippines, Bur. Sci. Monograph 23 (1927) 278.

This very distinct species was known only from a damaged specimen, 52 mm long, from the Manila market. I have a small but perfect specimen, 32 mm long, gathered from the mud flats at Opon, Mactan Island. The caudal is rounded rather than pointed, and is not as long as the head but is equal to the head without the snout.

CALLIONYMIDÆ

CALLIURICHTHYS FILAMENTOSUS (Cuvier and Valenciennes).

A fine male specimen, 76 mm long, or 107 mm with the caudal, was dredged from Manila Bay. New to the Philippines and known previously from Celebes and Amboina.

Dorsal I–III, 9; anal 9; caudal 14 (?).

The very large pointed head is as broad as long, measured to the gill opening, 3.8 times in the length; the caudal is almost half as long as the head and body; the hairlike first dorsal spine reaches to the posterior half of the second dorsal, 2.7 times, the last dorsal ray 5, the last anal ray 6.3, the pectoral 5, the ventral 4.47 times in the length. The eye is 3.33, the snout

2.85 times in the head; the straight opercular spine is slightly serrated above, about as long as the snout, and has a forward-pointing process above, near its base. The last dorsal and anal rays and the two middle caudal rays are much elongated, with more or less filamentous tips.

The color in alcohol is uniform reddish brown, the upper half with paler lobate spots; on the side, below the lateral line, are four irregular rows of black dots. The first dorsal has four black wavy crossbands; the second dorsal and pectoral are barred with black dots, the caudal by dark bands; the anal is clear with a dusky margin; the ventrals are reddish brown, with dark dots and mottlings.

TRICHONOTIDÆ

TRICHONOTUS SETIGERUS (Bloch and Schneider).

Two perfect specimens, 50 and 78 mm long, of this rare and elongate little fish were caught in Pansipit River, near the outlet of Lake Bombon, Batangas Province, Luzon. Previously known in the Philippines from specimens obtained on the east coast of Mindoro.

Dorsal 46 to 49; anal 36 to 38; scales in the lateral line 55 to 58, plus 2 on the caudal base.

The depth is 13, the breadth 15.6, the head 4.9, the caudal 7 times in the length; the eye is 5.33, the snout 3.55, the maxillary 3.2 times in the head. The strongly projecting lower jaw has a terminal papilla projecting upward above the snout tip; the mouth is large, the maxillary reaching beneath the front margin of the pupil.

The color in alcohol is yellowish gray thickly strewn with dark brown above, and with thirteen broad brown crossbands over the back; the first two are before the first dorsal, the last one on the caudal base; the sides of the head are clear with five large dark brown circular spots, evidently ocelli in life. The first four dorsal rays are black with a white or colorless crossband on the upper half; the other fins colorless, except the caudal which is dark brown with crossbands of white spots.

BLENNIIDÆ

ANDAMIA CYCLOCHEILUS M. Weber.

Andamia cyclocheilus M. WEBER, Fische Siboga Exped. (1913) 538, pl. 3, fig. 3.

Dorsal XV, 19 or 20; anal 24 to 26.

A specimen of this strange blenny, 66 mm long, was taken at Puerto Galera, Mindoro. New to the Philippines. Its color is

uniformly blue-black, without spots or bands, the fins brownish black.

The depth is 7.33, the head 5.5, the caudal 3.3, the pectoral 5 times in the length; the eye is 3, the snout 2.4, the interorbital 4, the ventral 2.4 times in the head. The second and third dorsal spines are a little elongated. There is a fimbriated ocular tentacle.

I also collected 20 examples, 28 to 77 mm long, near Menado, Celebes. Large males have the anterior dorsal spines, or all the dorsal spines, except the first, much elongated. The caudal rays are undivided, their tips filiform and free. A male 77 mm long has the depth equal to the head, 6 times, the caudal 3.35, the pectoral 5.1, the ventral 11, the second dorsal spine 3.2 times in the length; the eye and interorbital are equal, 4.33 times, the snout and ventral each 1.85 times in the head.

The color in alcohol is uniform purplish brown, with or without paler violet or whitish spots and short irregular bars over the head, back, and sides; the dorsal, caudal, and pectoral are brown, violaceous, or colorless; the anal may be colorless, or blackish blue with white margin; the ventral white.

From *Andamia expansa* Blyth this species is separated by the shape of its adhesive sucker, which is a semicircular or oval disk behind the mouth, instead of the double-pointed one of *A. expansa.*

Previously known only from one specimen from New Guinea, three from Flores, and one from the "East Indies."

CRISTICEPS XANTHOSOMA (Bleeker).

Dorsal III–XXVII, 4; anal II, 19.

The depth is 4, the head 3.48, the caudal and pectoral each 5.55, the ventral 6.1 times in the length; the eye is 4.16, the snout 5, the maxillary 2.7, and the interorbital 7 times in the head.

The deep body is laterally compressed, the ventral profile strongly convex; the head is moderately arched from the dorsal origin to the tip of the projecting lower jaw; the eyes are high up, lateral, with a fimbriate tentacle on the margin of each, half or more than half the eye in length; a small simple nasal tentacle; the mouth is strongly oblique, the maxillary extending beneath the front margin of the pupil; the small teeth form a band of five rows in front, dwindling to a single row posteriorly, alike in both jaws; minute teeth on vomer and palatines. The dorsal spines are all hard and sharp-pointed, with only four divided rays at the posterior end of the dorsal fin; the anal spines are

likewise hard and sharp. The vertical fins are low, the first dorsal spine 2.5 in the head; the second dorsal is uniform in height, 3.18 in the head, the first dorsal ray equal to the first dorsal spine; the anal rays are of uniform height, 2.9 in the head.

The color in alcohol is uniform yellow, all fins as well as body.

This handsome blenny, previously unknown in the Philippines, is represented by a specimen 61 mm long, from a reef at Paraoir, La Union Province, Luzon. Hitherto known only from Java, from specimens described by Bleeker in 1857.

PETROSCIRTES TÆNIATUS (Quoy and Gaimard).

This lovely blenny is one of the handsomest denizens of the coral reefs of the East Indies and Polynesia. Though not rare it is difficult to collect. A specimen 93 mm long from Calapan, Mindoro, is apparently the first recorded from the Philippines. I have seen it at Dumaguete, and at various places in the Sulu Archipelago, but have been unable to secure specimens.

In life it is a beautiful blue with a black band from the tip of the snout to the tip of the caudal fin, narrow anteriorly and more than twice as wide posteriorly; the dorsal and anal have a narrow white margin. In alcohol the blue fades considerably, the colors otherwise unchanged.

This fish swims with a peculiar rocking and twisting motion, inclined first to one side and then to the other as it speeds swiftly forward.

ILLUSTRATIONS

[Drawings by P. Bravo.]

PLATE 1

FIG. 1. *Cæcula philippinensis* sp. nov.; *a*, under side of head showing irregular position of gill openings.
2. *Syngnathus martini* sp. nov.
3. *Vaimosa montalbani* sp. nov.

PLATE 2

FIG. 4. *Ctenogobius villadolidi* sp. nov.
5. *Schismatogobius roxasi* sp. nov.
6. *Mars haydeni* sp. nov.
7. *Salarias fowleri* sp. nov.

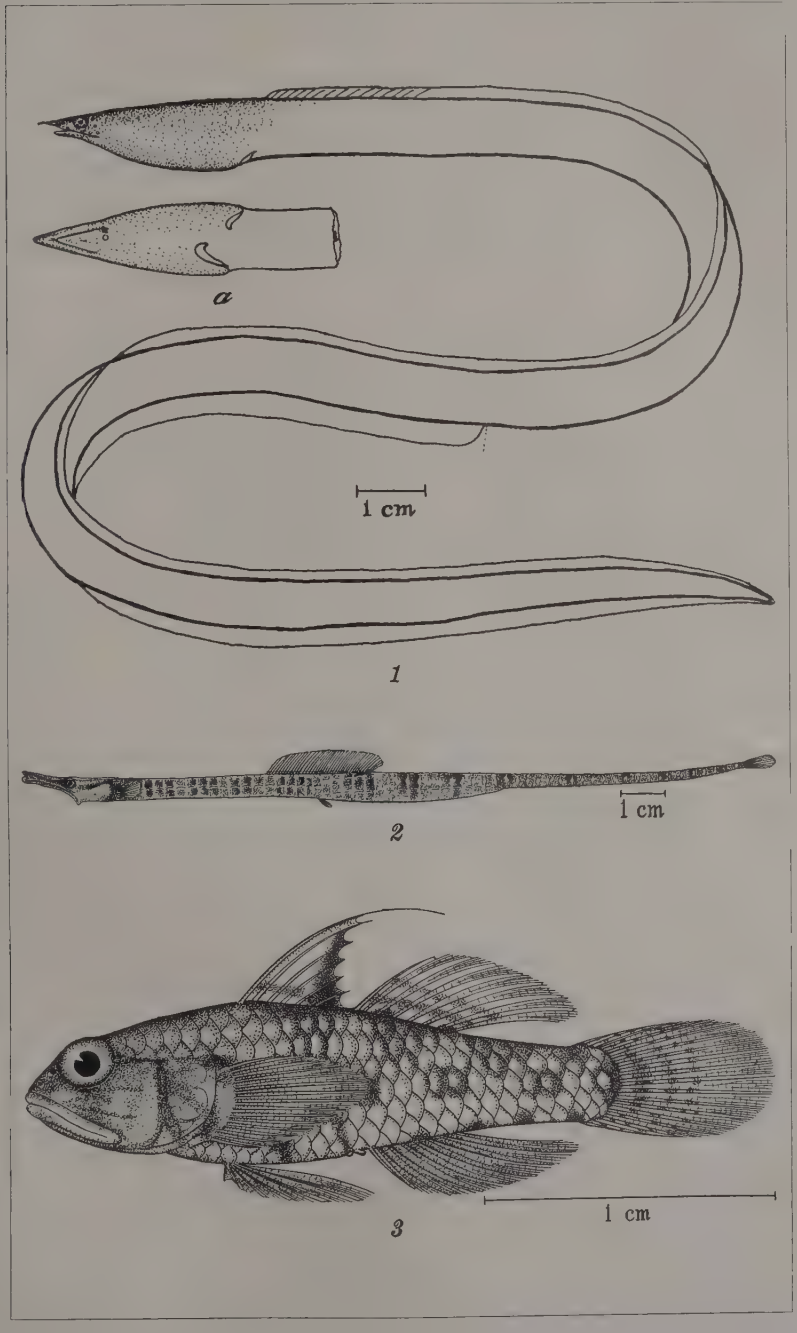
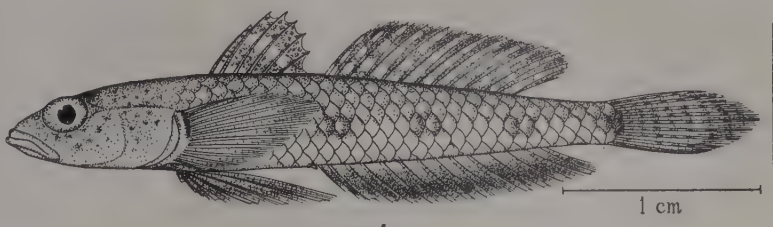
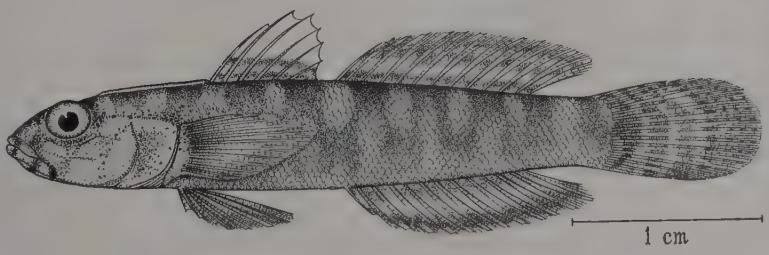


PLATE 1.



4

5



6

7

PLATE 2.

A NEW PHALLOSTETHID FISH WITH NOTES ON ITS DEVELOPMENT

By Porfirio R. Manacop

Of the Fish and Game Administration, Bureau of Science, Manila

TWO PLATES

August 27, 1935, some live phallostethid fishes were caught in a gourami pond at Barrio Laput, Mexico, Pampanga. Only ten living females, presumably impregnated, reached the laboratory in Manila, all the males having died on the way. They were placed in a balanced aquarium, and the following morning some eggs were found attached by some adhesive thread-like processes to leaves of *Anacharis*. They were transferred to petri dishes and their development followed and studied.

A close examination of the adult showed that this fish is a new species. Three genera and five species of Phallostethidæ are now known in the Philippine Islands, two species in brackish water and three in fresh-water streams and ponds. *Gulaphallus mirabilis* was first reported by Herre (1925) from Ipo Creek, Bulacan, and Molawin Creek, Los Baños, Laguna; *G. eximius* Herre (1925) from a creek at Santa Fe, Nueva Vizcaya; *Mirophallus bikolanus* Herre (1926) from Lake Lanigay, Albay Province; *Gulaphallus amaricola* Villadolid and Manacop (1934) from the sloughs of Manila Bay in Pasay, Rizal; *Plectrostethus palawanensis* Myers (1935) from the mouth of Caiholo River, Ulugan Bay, Palawan; and *Gulaphallus falcifer* sp. nov. from gourami ponds at Mexico, Pampanga, and Nampicuan, Nueva Ecija.

GULAPHALLUS FALCIFER sp. nov. Plate 1, figs. 1, 1a; 2, 2a.

Head 2.9; depth 5.42 (male), 4.56 (female); first dorsal II; second dorsal I, 6; pectoral 9; anal I, 15–16; caudal 30; scales 30 to 32 in median lateral series; 7 in transverse series counted from base of second dorsal to posterior end of anal; 14 to 16 predorsal scales.

Body compressed laterally, dorsal profile very slightly elevated, ventral profile strongly convex in the female; greatest depth at level of anal origin; body tapering gradually to caudal base, least depth of caudal peduncle 1.88 in body.

Head small, with bluntly rounded snout and more or less projecting chin. Mouth small and nearly vertical, lower lip slightly greater than the upper. Teeth finely pointed in two rows, in both jaws. Upper maxillary not extending beyond margin of eye. Eyes large, 2.71 in head, impinging on dorsal head profile. Interorbital space flat, equals eye. Three to four branchiostegal rays prominent and clearly visible externally.

First spinous dorsal soft and very short, inserted directly above base of sixth anal ray. Second dorsal about 1.8 in head, inserted above tenth anal ray. Pectorals with rather thick muscular bases, shorter than head, second ray longest. Ventrals absent. Base of anal fin about three times that of second dorsal, the first ray longest. Caudal not deeply forked, about 1.2 times greater than head.

Male with one greatly curved, slender ctenactenium, articulating from lateroposterior part of priapium. Tip of ctenactenium strongly curved, resting in a groove formed by chin and anterior end of priapium. Pulvinulus (Plate 1, fig. 1) shield-like, narrower but longer than eye, free along its anterior and ventral margins. A fleshy, tubular, somewhat laterally directed structure, possibly the intromittent organ (Plate 1, fig. 1a, *io*) and formed by the terminal portion of the coiled vas deferens located at posterior end of priapium.

Female with a scythelike osseous postanal papilla (Plate 1, figs. 1, 3 and 4, *pl*) about 3 mm in length, originating medially from a point just below base of pectoral and a little behind anal opening; papilla covers openings of oviduct and ureter.

In life body transparent, gill regions reddish, fins colorless and transparent. A distinct dark blotch, darker in female, on abdominal region just anterior to anal fin origin. A prominent minute dark spot on vertex, pectoral base, and chin. A fine dark line along base of anal. A median dark line originating from about base of pectoral to caudal base.

The fish closely resembles *Neostethus lankesteri* Regan (1916) in general appearance, but differs markedly from this in the absence of comblike projections located at the posterior end of the priapium in the male and the presence of a well-developed postanal papilla in the female. The position of the postanal papilla is similar to that in *Neostethus bicornis* Regan (1916). *Neostethus bicornis* Regan, however, has a pair instead of a single enlarged papilla. Myers (1928) claims that the papilla perhaps represent the pelvic fins, while Regan (1913) calls them pelvic fins in his description of *Phallostethus dunckeri*.

Here described from the holotype, Philippine Fish and Game Administration No. 31778, adult male, 27.5 mm standard length (34.0 mm total length), collected by C. Sandiko in a gourami pond at Barrio Laput, Mexico, Pampanga Province, Luzon, August 27, 1935.

Allotype.—F. G. A. No. 31779, adult, female, 26.5 mm standard length (23 mm total length). The same locality and date.

Paratypes.—F. G. A. No. 31780, 17 specimens (20 to 34 mm); 8 females and 9 males. The same locality and date.

Falcifer, a scythe-bearing individual.

EMBRYOLOGY OF GULAPHALLUS FALCIFER SP. NOV.

The newly laid eggs were transferred to petri dishes, and the tap water was changed daily up to the time of hatching.

All observations and illustrations were made exclusively on living material. The embryonic development of the egg was followed up to the time of hatching.

The newly laid eggs.—The eggs (Plate 2, fig. 1) are highly transparent, spherical, 1 to 1.1 mm in diameter. They are demersal and held together in ropy clumps by a tangle of adhesive threadlike processes (*at*). A tuft of these processes arising from a point on the egg membrane of each egg attaches it to leaves and stems of aquatic plants.

Ten to fifteen large oil globules of different sizes and numerous small ones are discernible in the egg.

Incubation period.—The incubation period under laboratory conditions in August, 1935, lasted from nine to eleven days.

Later cleavage stages to formation of the primitive streak.—The day after it is laid, the egg is observed to be in an advanced stage of cleavage. Plate 2, fig. 2, shows the blastoderm covering almost one-third of the egg. The periblast (*pb*) is also in evidence. On the third day after laying, the germ ring becomes manifest (Plate 2, fig. 3). It appears as a thickened peripheral zone of the blastoderm (fig. 3, *gr*). Before the germ ring is fully evident, invagination probably has advanced more rapidly at one pole than on the rest of the periphery of the blastoderm. This process results in the formation of the embryonic pole (fig. 5, *pp*). At this pole a broad tonguelike group of cells is pushed toward the cleavage cavity (fig. 5, *c*). This marks the early stage of the embryonic shield (fig. 5, *es*).

The blastoderm increases in size very rapidly, and the germ ring advances around the yolk. During this time the embryonic shield grows larger and becomes more definitely outlined. Four

hours from the formation of the germ ring there occurs a linear thickening along the anteroposterior axis of the embryonic shield. This linear thickening is the primitive streak, and marks the axis of the embryo, which now extends over about one-third of the surface of the egg.

Later embryonic stages.—Four days after the egg is laid the optic vesicles and ten to twelve somites are in evidence (Plate 2, fig. 6, *s*). Small rounded black dots, which first appear on the dorsoposterior aspect of the head, later develop into pigmented processes. The heart, which appears like an ovoid sac along the throat region, becomes recognizable on the fifth day after laying. At this time the heart begins to beat slowly. The embryo, which is now fully recognizable, extends over more than half of the yolk sphere. The membranous fold, which extends from the middorsal region around the caudal end and along the ventral side of the embryo, is already in evidence.

Embryonic circulation commences six days after laying (Plate 2, fig. 8). The beating of the heart at this time is comparatively faster than on the fifth day. The head becomes relatively broad, and the body tapers gradually toward the posterior end.

Seven days after the egg is laid the primordia of the pectoral fins (Plate 2, fig. 9, *p*) become evident. They appear as uneven triangular protrusions at the pectoral region. The eyes become pigmented. The head has grown considerably in size, and the embryo has grown over the yolk sphere completely. The chromatophores have increased on the dorsal aspect of the head and trunk.

As the time of hatching approaches, the embryo grows larger and the yolk becomes materially reduced (Plate 2, figs. 10 and 11). A network of blood vessels becomes evident over the surface of the yolk sphere. The black pigments have grown larger and more numerous, and the embryo begins to wiggle furiously. The pectoral fin primordia have developed into ovate pectoral fins. Nine days after the egg is laid, the young fish becomes liberated from the egg membrane and begins to swim about.

The newly hatched fish.—The newly hatched fish (Plate 2, fig. 12) is approximately 3.5 mm in length. The head is large, more or less flattened ventrally, and strongly convex dorsally. The eyes are large and bulge out of their sockets. The semiovoid yolk sac, which has a few scattered pigments spots, remains relatively large. The vent is located just behind the margin of the yolk sac. The body tapers gradually from the vent towards the posterior end. The fin folds and the posterior

caudal region of the body remain entirely free from pigments. The chromatophores have developed into large blotches on the dorsal aspect of the head, and numerous small ones are distributed along the dorsal aspect of the body and along the upper border of the notochord.

The newly laid egg of *G. falcifer* differs from that of *G. mirabilis* (Villadolid and Manacop, 1934) in that the former has fewer oil globules. Moreover, while the threadlike processes of the egg of *G. falcifer* arise from a common base, those of *G. mirabilis* are scattered over the egg membrane. This mode of attachment of the threadlike processes in *G. falcifer* is similar to that of *Menidia menidia notata* (Kuntz and Radcliffe, 1916), a close relative of the species.

In the length of the incubation period under laboratory conditions, *G. mirabilis* and *G. falcifer* do not differ widely, the period being from eight to eleven days.

The embryonic development of *G. falcifer* is entirely typical of the teleostean egg and does not differ essentially from that of *G. mirabilis*. The difference lies only in the time of the differentiation of the various embryonic parts. This may be attributed to the difference in conditions obtaining during the observations.

LITERATURE CITED

HERRE, ALBERT W. Two strange new fishes from Luzon. Philip. Journ. Sci. 27 (1925) 507–514, pl. 2, figs. 1–10.

HERRE, ALBERT W. Four new Philippine fishes. Philip. Journ. Sci. 31 (1926) 538–541, pl. 3, figs. 1–8.

KUNTZ, ALBERT, and LEWIS RADCLIFFE. Notes on the embryology and larval development of twelve teleostean fishes. Bull. U. S. Bur. Fish. 35 1915 (1916) 89–134, pl. 27, figs. 1–126.

MYERS, GEORGE S. The systematic position of the phallostethid fishes, with diagnosis of a new genus from Siam. Am. Mus. Novitates No. 295 (1928) 1–12, figs. 1–2.

MYERS, GEORGE S. A new phallostethid fish from Palawan. Proc. Biol. Soc. Wash. 48 (1935) 5–6.

REGAN, C. T. Phallostethus dunckeri, a remarkable new cyprinodont fish from Jahore. Ann. & Mag. Nat. Hist. VII 8 (1913) 548–555.

REGAN, C. T. The morphology of the cyprinodont fishes of the subfamily Phallostethinae, with descriptions of a new genus and two new species. Proc. Zool. Soc. London Part I (1916) 1–26, pl. 4, figs. 1–8, text figs. 1–15.

VILLADOLID, D. V., and P. R. MANACOP. The Philippine Phallostethidæ, a description of a new species, and a report on the biology of Gulaphallus mirabilis Herre. Philip. Journ. Sci. 55 (1934) 193–220, pl. 5, figs. 1–37, text figs. 1–3.

ILLUSTRATIONS

[Drawings by Angel D. Lagman.]

PLATE 1

[*pv*, Pulvinulus; *ct*, ctenactinium; *io*, intromittent organ; *a*, anus; *o*, opening of oviduct; *pl*, postanal papilla; *i*, intestine; *ov*, ovary.]

FIG. 1. *Gulaphallus falcifer* sp. nov., male; 1a, ventral aspect of head region of male (× 7).
2. *Gulaphallus falcifer* sp. nov., female; 2a, ventral aspect of head region of female (× 7).
3. Head portion of female made transparent to show relative position of papilla to internal organs.
4. Bone of papilla removed and enlarged (× 20).

PLATE 2. EGGS OF GULAPHALLUS FALCIFER SP. NOV.

FIG. 1. A group of newly laid eggs attached by adhesive threads to a portion of a leaf of *Elodea* (× 30); *at*, adhesive threads.
2. Egg with blastoderm in late cleavage stage (× 40); *bl*, blastoderm.
3. Germ-ring stage; *gr*, germ ring; *pp*, posterior pole; *c*, cleavage cavity; *es*, embryonic shield.
4. Primitive-streak stage; *ps*, primitive streak.
5. Egg with advanced embryo with 10 to 12 somites (lateral view); *sm*, somites; *p*, black pigments.
6. Same as fig. 5 (top view).
7. Fifth-day embryo; *h*, heart.
8. Sixth-day embryo.
9. Seventh-day embryo; *pp*, pectoral primordia.
10. Eighth-day embryo; *pf*, pectoral fin.
11. Ninth-day embryo.
12. Newly hatched fish (× 5); *v*, vent; *ys*, yolk sac.

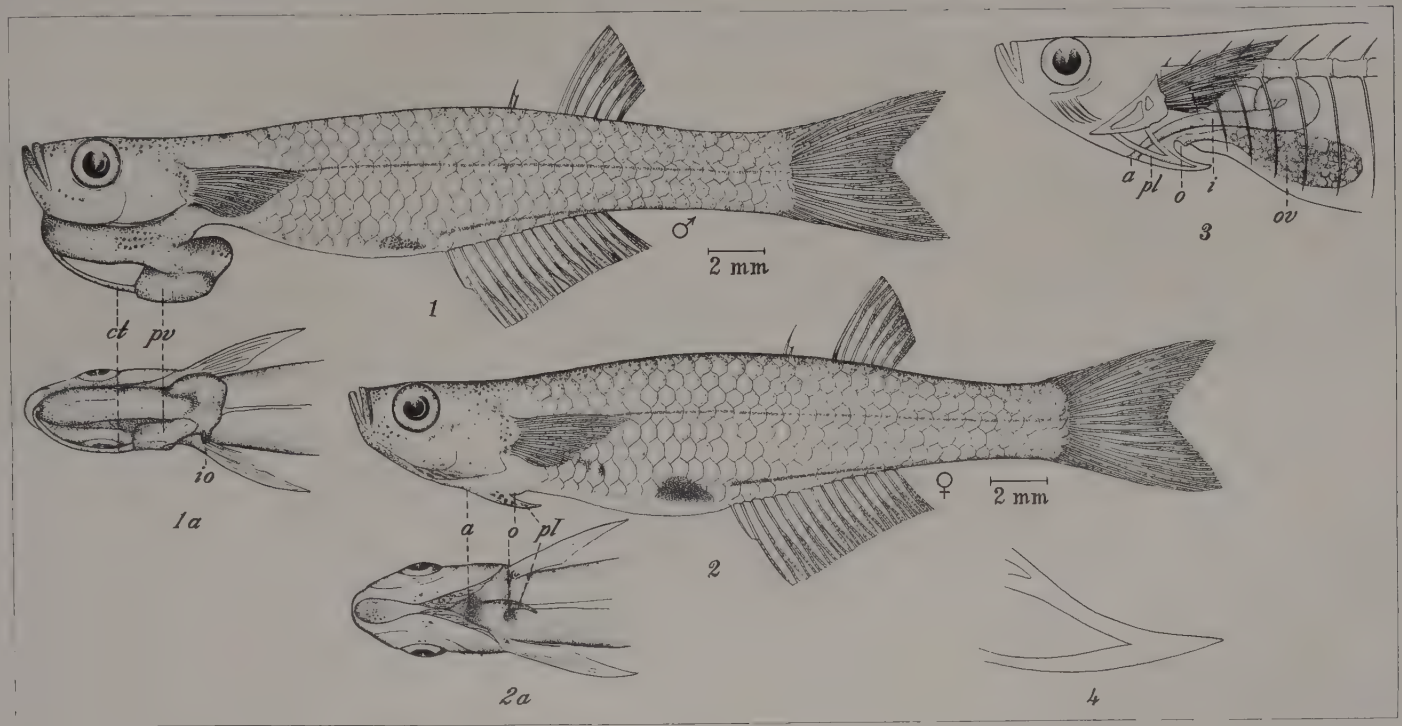


PLATE 1.

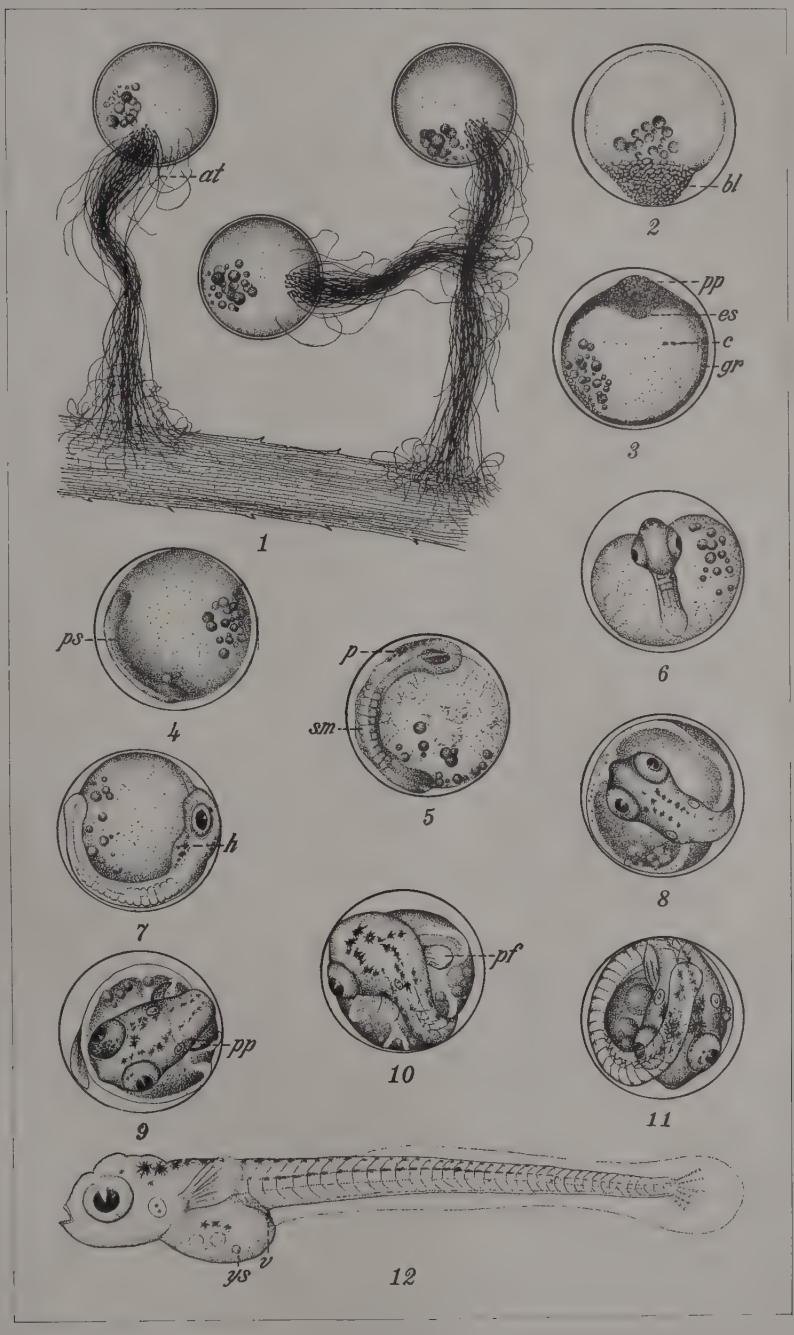


PLATE 2.

THE SEXUAL MATURITY OF SOME COMMERCIAL FISHES CAUGHT IN MANILA BAY

By Porfirio R. Manacop

Of the Fish and Game Administration, Bureau of Science, Manila

Because of its rich fishery resources and its proximity to Manila markets, Manila Bay is perhaps the best fishing center of the Philippines. It has an approximate area of 720 square miles,[1] an average depth of about 3 to 4 fathoms, and a more or less smooth and muddy bottom suitable for fish-trawling.

There are now about seventy-three beam trawlers operating in Manila Bay. This number slightly changes from time to time as a few trawlers shift to other fishing grounds like Ragay and Lingayen Gulfs and waters adjacent to Negros. The majority of them, however, operate in Manila Bay throughout the year.

The rapid increase of gears and the redoubling of effort in the catching of fish in this limited body of water would in the long run, if not restricted, lead to the depletion of its fishery resources. The study, therefore, of the size limits of the commercial fishes caught in Manila Bay is urgently needed in order to have some basis for regulating these beam trawlers. The regulations would in turn reduce the enormous waste in the form of unmarketable and immature fishes which are unavoidably caught by these gears.

This is the first study of this nature on Philippine marine fishes, and the literature on the subject is rather scanty. Most of the studies on the species treated in this paper deal with their taxonomy, with some notes on their distribution and habitat. Walford (1932) reported the size and age groups and the breeding habits at sexual maturity of the California barracuda (*Sphyræna argentea*).

Some extensive work of this nature had already been done by Mane (1929 and 1932) on fresh-water fishes of Laguna de Bay, specifically on *Arius* spp., Arridæ, and on *Mesopristes plumbea* Kner, Theraponidæ.

[1] Port of Manila; Year Book (1931) 1–43.

The absence of winter markings on the scales and otolith bones of tropical fishes is a handicap in the study of age at sexual maturity of Philippine fishes. An additional difficulty is that the spawning of most species of fishes in the Philippines is not confined to a part of the year, but takes place all the year round. The determination of age was, therefore, dispensed with and the work was confined to the study of the size groups at sexual maturity.

This paper is a study on the determination of the size limits of some of the commercial fishes caught in Manila Bay. These fishes are the following:

1. *Johnius aneus* (Bloch); plain croaker; Sciænidæ; Tagalog name: Alakaak.
2. *Gerres filamentosus* Cuvier and Valenciennes; spotted mojarras; Gerridæ; Tagalog name: Malakapas.
3. *Nemipterus japonicus* (Bloch); long-tailed nemipterid; Nemipteridæ; Tagalog name: Bisugong buntutan.
4. *Saurida tumbil* (Bloch); common lizard fish; Synodontidæ; Tagalog name: Kalaso.
5. *Sphyræna jello* Cuvier and Valenciennes; banded barracuda; Sphyrænidæ; Tagalog names: Torcillo (small), asogon (large).
6. *Sphyræna obtusata* Cuvier and Valenciennes; striped barracuda, Sphyrænidæ; Tagalog names: Torcillo (small), asogon (large).

The first four named form a large part of the hauls of the beam trawls in Manila Bay. At times fish corrals also catch these species in considerable quantities. The last two species are hard-fighting game fishes, sought by sport anglers, and are caught in small quantities in fish corrals in Manila Bay.

METHODS

Collection of material.—The material for this study was collected from September, 1934, to April, 1935, inclusive. The material, which consisted of from ten to twenty specimens in a sample a week, was mostly taken from the catch of the Japanese beam trawls operating in Manila Bay. The catch of the fish corrals operating in the Bataan portion of Manila Bay offered also a considerable amount of material. The material was preserved in 10 per cent formalin for about twenty-four hours and transferred to 70 per cent denatured alcohol before examination.

Measurements.—The measurements of the fish are usually made after they have been preserved in 70 per cent alcohol. The standard and total lengths of each fish examined are taken. All measurements are made by means of a measuring board with the aid of a dividers and a millimeter rule. The measure-

ments of the ova are made under a compound microscope with an ocular micrometer. The sample of ova taken at the middle portion of the ovary is teased out on a collumned glass slide and measured. By this method the error of measuring any ovum twice is minimized.

Determination.—The maximum, minimum, and average sizes at sexual maturity of both sexes whenever possible are ascertained. For the males the presence of milt when pressed and the whiteness and enlargement of the testes are taken as criteria for sexual maturity. The presence of maturing eggs is taken as an index for the maturity of the females. Most males are examined while in the fresh state, their maturity being easily determinable.

The gross examination of the ovary to ascertain the maturity of the female is aided by measurement and examination of the ova. In addition certain criteria that make it possible to differentiate, with the unaided eye, the ovaries into those that contain immature eggs, maturing eggs, and mature eggs are being used. In most of the females studied those with immature ovaries have ova that could not be seen by the naked eye, those that had maturing ovaries are granulated in appearance and have creamy white ova, while those with mature ovaries are yellowish to orange or translucent and have large ova loosely attached or completely free from the walls of the ovary.

SIZE AT SEXUAL MATURITY

1. *Johnius aneus* (Bloch); alakaak; Sciænidæ. Tables 1 and 5 show the results of the determination of the sexual maturity of the fish. Of the 479 males examined, 231 were mature and 248 immature. The male alakaak begins to mature at a minimum length of 11.5 centimeters. About 56 per cent of the males dissected were found to mature at 11.5 centimeters, about 78.94 per cent at 12 centimeters, and about 85 per cent at 12.5 centimeters. All males examined measuring 12.6 centimeters or more in length were sexually mature.

The female alakaak appears to mature at a length group of 11.5 to 12.6 centimeters. It may be seen from the table that both sexes mature within the same range. The average size at sexual maturity of both sexes is about 12 centimeters. Of the 403 females examined, 193 were mature and 210 immature. About 63.15 per cent of the females dissected were mature at a minimum of 11.5 centimeters, 70.33 per cent at 12 centimeters, and 83.33 per cent at 12.5 centimeters. Invariably,

females measuring 12.6 centimeters or more in length were mature.

TABLE 1.—*Size groups of sexually mature Johnius aneus (alakaak).*

Standard length.	Males.			Females.		
	Total.	Mature.	Per cent.	Total.	Mature.	Per cent.
cm.						
7.0- 7.5	19			13		
7.6- 8.0	24			16		
8.1- 8.5	38			28		
8.6- 9.0	40			31		
9.1- 9.5	26			38		
9.6-10.0	31			20		
10.1-10.5	32			23		
10.6-11.0	21			23		
11.1-11.5	23	13	56.52	19	12	63.15
11.6-12-0	19	15	78.94	27	19	70.37
12.1-12.5	20	17	85.00	18	15	83.72
12.6-13.0	25	25	100.00	18	18	100.00
13.1-13.5	19	19	100.00	17	17	100.00
13.6-14.0	23	23	100.00	15	15	100.00
14.1-14.5	31	31	100.00	25	25	100.00
14.6-15.0	28	28	100.00	19	19	100.00
15.1-15.5	13	13	100.00	12	12	100.00
15.6-16.0	13	13	100.00	18	18	100.00
16.1-16.5	12	12	100.00	12	12	100.00
16.6-17.0	0	0	00.00	0	0	00.00
17.1-17.5	0	0	00.00	11	11	100.00
17.6-18.0	11	11	100.00			
18.1-18.5	11	11	100.00			
Total	479	231		403	193	

2. *Gerres filamentosus* Cuvier and Valenciennes; malakapas; Gerridæ. Tables 2 and 5 show the size groups of sexually mature malakapas. Of the 175 males examined, 140 were sexually mature and 35 immature. The male begins to mature at a minimum size of 7.5 centimeters. At this size 12.5 per cent of the males examined were mature; about 58.33 per cent were mature at 8 centimeters and 85 per cent at 8.5 centimeters. At a maximum size of 9 centimeters all males examined were sexually mature, and all males above 9 centimeters in length were mature. The average size at sexual maturity of the male malakapas is 8.6 centimeters.

The female malakapas matures at a minimum size of 7 centimeters, like the male, at a maximum size of 8.5 centimeters, and at an average size of 7.9 centimeters. About 58.33 per cent of the females examined mature at this minimum size, and 95 per cent at 8 centimeters; females measuring 8.5 or more in length were mature. It may be seen further from Table 2 that

more females reach sexual maturity than males at size groups of from 7.1 to 8.5 centimeters. Of the 176 females examined, 167 were mature. The average size at sexual maturity of the female is about 7.9 centimeters. The majority of the samples examined were mature.

TABLE 2.—*Size groups of sexually mature Gerres filamentosus (malakapas).*

Standard length.	Males.			Females.		
	Total.	Mature.	Per cent.	Total.	Mature.	Per cent.
cm.						
6.5–7.0	13			3		
7.1–7.5	16	2	12.50	12	7	58.33
7.6–8.0	12	7	58.33	20	19	95.00
8.1–8.5	20	17	85.00	35	35	100.00
8.6–9.0	28	28	100.00	26	26	100.00
9.1–9.5	28	28	100.00	29	29	100.00
9.6–10.0	33	33	100.00	25	25	100.00
10.1–10.5	15	15	100.00	12	12	100.00
10.6–11.0	4	4	100.00	8	8	100.00
11.1–11.5	2	2	100.00	5	5	100.00
11.6–12.0	1	1	100.00	1	1	100.00
12.1–12.5	1	1	100.00			
12.6–13.0	1	1	100.00			
13.1–13.5	1	1	100.00			
Total	175	140		176	167	

3. *Nemipterus japonicus* (Bloch); bisugong buntutan; Nemipteridæ. The testes of this fish appear to be poorly developed in all the size groups examined. This makes it difficult to ascertain the state of maturity of the males; hence, the determination of its maturity was dispensed with.

TABLE 3.—*Size groups of sexually mature female Nemipterus japonicus (bisugong buntutan).*[a]

Females.							
Standard length.	Total number.	Mature.	Per cent.	Standard length.	Total number.	Mature.	Per cent.
cm.				*cm.*			
6.0–6.5	12			11.1–11.0	20	20	100.00
6.6–7.0	16			11.6–12.0	13	13	100.00
7.1–7.5	31	16	51.61	12.1–12.5	12	12	100.00
7.6–8.0	47	29	61.72	12.6–13.0	12	12	100.00
8.1–8.5	69	55	79.71	13.1–13.5	10	10	100.00
8.6–9.0	49	49	100.00	13.6–14.0			
9.1–9.5	32	32	100.00	14.1–14.5			
9.6–10.0	28	28	100.00	14.6–15.0			
10.1–10.5	23	23	100.00	Total	406	321	
10.6–11.0	22	22	100.00				

[a] No determination was made for the males.

The female bisugo matures at a minimum size of 7.6 centimeters, at a maximum size of 8.1 centimeters, and at an average size of 7.9 centimeters long (Tables 3 and 5). Of the 406 females examined, 321 were sexually mature and 85 were immature. About 51.61 per cent of the females examined were mature at the minimum size, about 61.72 per cent at 8 centimeters, and about 79.71 per cent at 8.5 centimeters. Females measuring 8.6 centimeters or more in length were all mature.

4. *Saurida tumbil* (Bloch); kalaso; Synodontidæ. Tables 4 and 5 show the results of the determination of the size at sexual maturity of kalaso. Of the 195 males examined, 158 were immature and 37 sexually mature. The male matures at size groups of from 18.5 to 21 centimeters long. About 50 per cent of the males examined were mature at 19 centimeters, about 53.72 per cent at 20 centimeters, and about 77.79 per cent at 21 centimeters. Invariably, all males longer than 21 centimeters were mature.

TABLE 4.—*Size groups of sexually mature Saurida tumbil (kalaso).*

Standard length.	Males.			Females.		
	Total.	Mature.	Per cent.	Total.	Mature.	Per cent.
cm.						
10.0–11.0	5			15		
11.1–12.0	16			27		
12.1–13.0	21			39		
13.1–14.0	26			44		
14.1–15.0	21			34		
15.1–16.0	17			22		
16.1–17.0	14			18		
17.1–18.0	16			20		
18.1–19.0	16	8	50.00	15	6	40.00
19.1–20.0	26	14	53.72	30	14	46.66
20.1–21.0	9	7	77.79	26	14	53.72
21.1–22.0	6	6	100.00	14	13	92.85
22.1–23.0	2	2	100.00	2	2	100.00
23.1–24.0				1	1	100.00
24.1–25.0						
25.1–26.0						
26.1–27.0						
27.1–28.0						
28.1–29.0						
Total	195	37		305	52	

The female kalaso begins to mature at from 18.5 to 22.1 centimeters. Of the 305 females dissected, 253 were immature and 52 mature. About 40 per cent were mature at 19 centimeters, 46.66 per cent at 20 centimeters, about 53.72 per cent at 21 centimeters, and about 92.55 per cent at 22 centimeters.

All females measuring 22.1 centimeters or more in length were invariably mature. The average sizes at sexual maturity of the male and female kalaso were 19.5 and 20.5 centimeters, respectively. It may be seen also from Table 1 that the beam-trawl catch of this species appears to show the preponderance of the immature group of both sexes.

5. *Sphyræna jello* Cuvier and Valenciennes; banded barracuda; Sphyrænidæ. The banded barracuda ordinarily reaches a length of from 1 to 1.5 meters. However, a specimen 10 feet long has been reported in Leiden, Holland, Buttikofer (1890).

From an examination of about 60 specimens collected from March to April, 1935, it was found that the male begins to mature at a total length of 32.4 to 34.1 centimeters with an average of 33.3 centimeters (Table 5). All males measuring 33.3 centimeters or more in length were sexually mature.

The female, however, matures at a total length of 32.5 to 34.9 centimeters with an average of 34.2 centimeters. All females longer than 34.9 centimeters were invariably mature.

TABLE 5.—*The minimum, maximum, and average lengths at sexual maturity of the fishes studied.*

Scientific name.	Minimum.		Maximum.		Average.	
	Male.	Female.	Male.	Female.	Male.	Female.
	cm.	*cm.*	*cm.*	*cm.*	*cm.*	*cm.*
Johnius aneus	11.5	11.5	12.6	12.6	12.1	12.0
Gerres filamentosus	7.0	7.0	9.0	8.5	8.6	7.9
Nemipterus japonicus	[a]	7.5	[a]	9.0	[a]	8.4
Saurida tumbil	18.5	18.5	21.1	22.1	19.5	20.5
Sphyræna jello	32.4	32.5	34.1	34.9	33.3	34.2
Sphyræna obtusata	21.5	22.1	23.7	23.4	22.8	22.9

[a] No determination was made.

The barracuda probably spawns from the later part of March to the early part of May. This is evidenced by the presence of rapidly maturing and a few mature eggs in some parts of the ovaries examined during March and April, 1935. This is corroborated by the observation of Prof. Luis Reyes, of the Bureau of Forestry. He noted after examining a number of individuals that during March, April, and May the barracudas were spawning or breeding around Look, Batangas Province. Walford (1932) reported that the California barracuda (*Sphyræna argentea*) spawns from April to September, indicating that the temperate region barracuda has a prolonged spawning season as compared with the Philippine barracudas.

The foregoing conclusions on the spawning of barracudas in the Philippines should be considered tentative only, on account of the fact that the observations were carried on for a short period.

6. *Sphyræna obtusata* Cuvier and Valenciennes; striped barracuda; Sphyrænidæ. The striped barracuda, which is the smaller of the two species, is also caught in fish corrals in Manila Bay. It reaches a length of about 40 centimeters.

Of the 50 specimens dissected, it was found that the male matures at a total length of 21.5 to 23.7 centimeters with an average of 22.8 centimeters. All males measuring 23.7 centimeters or more in length were mature.

The female, on the other hand, matures at a total length of 22.1 to 23.4 centimeters with an average of 22.9 centimeters. Like the banded barracuda it probably spawns from late in March to early in May as evidenced by the presence of ripe ova in some of the ovaries examined.

CONCLUSIONS AND RECOMMENDATIONS

1. The male and female alakaak mature at from 11.5 to 12.6 centimeters with an average length of about 12 centimeters.

2. The sexual maturity of malakapas ranges from 7 to 9 centimeters in the male and 7 to 8.5 centimeters in the female, while the average lengths are 8.6 and 7.9 centimeters, respectively.

3. The sexual maturity of the female bisugong buntutan ranges from 7.5 to 9 centimeters in length with an average of 8.4 centimeters.

4. The male kalaso reaches sexual maturity at from 18.5 to 21.1 centimeters long with an average of 19.5 centimeters. The sexual maturity of the female ranges from 18.5 to 22.1 centimeters long. As to size a greater number of males appear to mature earlier than the females.

5. The banded and striped barracudas probably spawn from late in March to early in May. It is recommended that further study be made on the biology of these fishes.

6. The male banded barracuda matures at a total length of from 32.5 to 34.1 centimeters with an average of 33.3 centimeters. The female matures at from 32.5 to 34.9 centimeters long with an average of 34.2 centimeters.

7. The sexual maturity of the striped barracuda ranges from 21.5 to 23.7 centimeters long for the male and 22.1 to 23.4 centimeters for the female. The average for both sexes is about 23 centimeters long.

8. It is recommended that careful analysis of the catch of the beam trawls, which are extensively operating in Manila Bay, be made in order to standardize the mesh opening of the nets if necessary.

9. A size limit for each of the commercial fishes studied should be made. The following size limits are recommended:

Species.	Standard length.	Total length.
	cm.	*cm.*
1. Alakaak	12.0	14.5
2. Malakapas	8.5	10.5
3. Bisugong buntutan	8.5	10.5
4. Kalaso	20.5	23.0
5. Banded barracuda	28.0	34.0
6. Striped barracuda	19.0	23.0

LITERATURE CITED

BUTTIKOFER, J. Reisebilder aus Liberia, Leiden 2 (1890) 45.

MANE, ANDRE M. A preliminary study of the life history and habits of kanduli (Arius spp.) in Laguna de Bay. Philip. Agriculturist 18 (1929) 91–118, pl. 7, figs. 1–6.

MANE, ANDRE M. Spawning and feeding habits of ayuñgin, Mesopristes plumbea (Kner), a common theraponid fish in Laguna de Bay. Philip. Agriculturist 28 (1934) 502–515.

WALFORD, LIONEL A. The California barracuda (Sphyræna argentea). Division of Fish and Game Bull. No. 73 (1932) 6–120, pl. 6, figs. 1–8.

THE ELATERID BEETLES OF THE PHILIPPINE ISLANDS

By R. H. Van Zwaluwenburg

Of the Experiment Station, Hawaiian Sugar Planters' Association, Honolulu

The last previous catalogue of the Philippine Elateridæ, or click beetles, is Schultze's (15[1]) published in 1916, in which one hundred twenty-seven species and varieties are listed. So much material, either new or from unrecorded localities, has since come to hand, that it seems timely to bring up to date our knowledge of this interesting family of insects.

A great amount of Philippine material has come to the writer for examination during the past few years. Practically all of it that was unusual or doubtful was referred by him to Mr. Edmond Fleutiaux, of Nogent-sur-Marne, France, a student whose knowledge of the Elateridæ of the world is unequaled. From this material Mr. Fleutiaux has described some fifty new species and identified numerous species not previously recorded from the Islands.

Foremost among the collectors in the Philippines who have added to a knowledge of this family is, of course, the late Prof. Charles F. Baker. A number of new elaterid species have been described from Professor Baker's captures since the Schultze catalogue appeared. An unusually large and interesting amount of material came from Mr. Fred C. Hadden during his residence for the Hawaiian Sugar Planters' Association in the Islands from 1930 to 1932. In addition to his own tireless collecting Mr. Hadden enlisted others to collect, among them Mr. H. C. Muzzall, who worked in the vicinity of Zamboanga, Mindanao, and Mr. L. H. Phillips in Bukidnon Province of the same island. The material from the Camarines Provinces of Luzon, in the Hadden collection, was collected by Mr. E. E. Schneider.

Additional contributions of value were made by the late Mr. Alonzo W. Lopez, of the Philippine Sugar Association, and by the late Dr. Fred Muir, of Honolulu. Other entomologists who contributed specimens are Dr. F. X. Williams and Mr. C. E. Pemberton, of the Hawaiian Sugar Planters' Association Ex-

[1] Numbers in parentheses refer to the appended bibliography.

periment Station, and Mr. R. C. McGregor, of the Philippine Bureau of Science, who collected most of the specimens in a collection submitted by Cornell University.

Of the two hundred four species and eleven varieties here listed, one hundred sixty-nine (about 78 per cent) are known only from the Philippines at present. The affinities of the family in the Archipelago are more Indomalayan than Australasian, a conclusion already made familiar by studies of other faunal groups. A total of thirty-nine species (about 18 per cent) are known to occur elsewhere in the Indomalayan Region, while only ten species in the Islands are common to the Australasian Region. This disparity is perhaps accentuated by the fact that much more collecting has been done in Luzon than in the southeastern islands where invasion by Australasian species might reasonably have occurred more readily. Of the one hundred fifty-four Luzon species, 16 per cent (26 species) are common to the outlying Indomalayan fauna, and 4.5 per cent (7 species) to the Australasian. Of the seventy-seven species known from Mindanao, 19 per cent (15 species) occur elsewhere in Indomalaya, and 7.7 per cent (6 species) in the Australasian Region.

Known from the Philippines only	170
Common to the Philippines and:	
The rest of the Indomalayan Region	39
Borneo and adjacent islands	24
Java	15
Sumatra and adjacent islands	15
Indo-China	12
Australasian Region	10
Celebes	7

The following list shows the total species and varieties present on each of the Philippine Islands for which there are definite records:

Babuyanes	6	Panay	7
Calayan	1	Negros	13
Camiguin	1	Cebu	3
Luzon	15	Bohol	8
Alabat	2	Leyte	3
Batan	1	Panaon	1
Mindoro	3	Palawan	17
Sibuyan	3	Balabac	12
Masbate	3	Mindanao	77
Ticao	1	Basilan	5
Samar	2	Jolo	2

This catalogue is offered in the hope of stimulating interest in this family in a region unusually rich. After more or less incidental collecting on some twenty islands of this extensive group, the Philippines proves to have an elaterid fauna eight times richer per unit area than that of the continental United States. Luzon is the only island on which adequate collecting has even been approximated; the large southern islands are probably equally rich.

Names of islands are printed in capitals and small capitals. Names following locality citations are of collectors, unless otherwise indicated. Authority for a locality, other than of a type, is indicated by an author's name accompanied by a number which refers to the bibliography. In the absence of such information, the present compiler is responsible for the identification, except that references to the Fleutiaux collection are from identifications made by Mr. Fleutiaux himself. An asterisk before a name indicates a new island record for the Philippines.

In conclusion, the generous assistance of Mr. Fleutiaux, who added numerous new records, is gratefully acknowledged by the writer who alone is responsible for any inaccuracies in the compilation.

Genus AGRYPNUS Eschscholtz

1. AGRYPNUS BIFOVEATUS Candèze.

Agrypnus bifoveatus CANDÈZE, Mon. des Elat. 1 (1857) 41.

All the islands (Candèze 2). CEBU, Toledo (Schultze 15). LUZON, Cagayan Province, Tuguegarao (Schultze 15): Camarines Sur Province, Mabatobato, Pili (Hadden, May): Laguna Province, Los Baños (Fleutiaux 4), Mount Maquiling (Hadden): Tayabas Province (Schultze 15): Manila (McGregor). *MINDANAO, Surigao Province (Cornell collection), Tambanan, Kabasalan (Muzzall, January).

This species occurs also in Guam.

2. AGRYPNUS JAVANUS Candèze.

Agrypnus javanus CANDÈZE, Mon. des Elat. 1 (1857) 44.

LUZON, Tarlac Province, Pura, Anao (Schultze 15). *MINDANAO, Bukidnon Province, Tanculan (Baker; Fleutiaux collection). TICAO (Schultze 15).

Originally described from Java; this species is known also from Sumatra and the Malay Peninsula.

3. AGRYPNUS LOPEZI Fleutiaux.

Agrypnus lopezi FLEUTIAUX, Proc. Haw. Ent. Soc. 8 (1934) 477.

MINDANAO, Bukidnon Province, Diklom, 2,000 feet (Phillips, March) (type locality); Santa Fe, 3,000 feet (Phillips, May to August).

This species was named in memory of the late Alonzo William Lopez, entomologist of the Philippine Sugar Association.

4. AGRYPNUS MUCRONATUS Candèze.

Agrypnus mucronatus CANDÈZE, Mon. des Elat. 1 (1857) 42.

*LUZON, Laguna Province, Mount Maquiling, 400 feet (Hadden, July; Fleutiaux det.).

Originally described from Borneo; a variety occurs in Indo-China.

5. AGRYPNUS PONDERATUS Candèze.

Agrypnus ponderatus CANDÈZE, Elat. nouv., fasc. 6 (1896) 5.

MINDANAO (type locality). PALAWAN, Mount Salacot (Schultze 15).

6. AGRYPNUS ROBUSTUS Fleutiaux.

Agrypnus robustus FLEUTIAUX, Bull. Soc. ent. France (1902) 163.

CEBU, Toledo (Schultze 15).

Described from Java; known also from Ceylon, Malacca, Indo-China, and Borneo.

7. AGRYPNUS TOMENTOSUS (Fabricius).

Elater tomentosus FABRICIUS, Ent. Syst. (1798) 138.

Throughout the Archipelago (Candèze 2). *LUZON, Ambos Camarines Province, Mount Isarog (Cornell collection): Camarines Sur Province, Mabatobato, Pili (Hadden, May): Laguna Province, Mount Maquiling, 2,000 feet (Hadden, April to June; Fleutiaux det.): Nueva Vizcaya Province, Imugan (Cornell collection). PALAWAN, Iwahig (Schultze 15).

Candèze (1, 1: 41) records it at the roots of banana.

Genus LACON Laporte de Castelnau

8. LACON INCOMMODUS Fleutiaux.

Lacon incommodus FLEUTIAUX, Bull. et Ann. Soc. ent. Belg. 74 (1934) 364.

MINDANAO, Davao (Baker) (type locality).

9. LACON LUZONICUS (Candèze).

Adelocera luzonica CANDÈZE, Bull. Soc. ent. Belg. (1875) 119.

LUZON (type locality).

10. LACON MODESTUS (Boisduval).

Agrypnus modestus BOISDUVAL, Voy. Astrolabe, Coleop. (1835) 108.
Agrypnus pruinosus FAIRMAIRE.
Agrypnus squalidus FAIRMAIRE.
Agrypnus nigroplagiatus L. BLANCHARD.
Adelocera guadulpensis CANDÈZE.
Adelocera vicinus CANDÈZE.
Adelocera tessellatus CANDÈZE.

JOLO (Fleutiaux 1). LUZON (Candèze 3). MINDANAO, Davao (Fleutiaux 7).

Throughout the Tropics of the world.

11. LACON NOVUS Fleutiaux.

Lacon novus FLEUTIAUX, Bull. et Ann. Soc. ent. Belg. 54 (1934) 364.

LUZON, Tayabas Province, Mount Banahao (type locality).

12. LACON (ADELOCERA) PHILIPPINUS Fleutiaux.

Lacon (Adelocera) philippinus FLEUTIAUX, Proc. Haw. Ent. Soc. 8 (1934) 478.

MINDANAO, Zamboanga Province, Kabasalan (Muzzall, April) (type locality).

Described from a single specimen.

Genus ADELOCERA Latreille

13. ADELOCERA (COMPSOLACON) APODIXA (Candèze).

Lacon apodixus CANDÈZE, Elat. nouv., fasc. 1 (1865) 9.

CAMIGUIN (Babuyanes) (Schultze 15). LUZON (type locality), Cagayan Province, Tauit (Schultze 15). MINDANAO (Candèze 2). MINDORO, Bongabon (Schultze 15).

14. ADELOCERA (COMPSOLACON) BAKERI (Fleutiaux).

Lacon bakeri FLEUTIAUX, Philip. Journ. Sci. § D 11 (1916) 219.

MINDANAO, Agusan Province, Butuan (type locality).

15. ADELOCERA (COMPSOLACON) CERVINA (Erichson).

Lacon cervina ERICHSON, Beitr. Zool. Meyen's Reise, Acta Leop. Car. 16 Suppl. 1 (1834) 230.

All the islands (Candèze 2). CALAYAN (Babuyanes) (Schultze 15). LUZON (type locality): Bataan Province, Lamao (Schultze 15): Laguna Province, Mount Maquiling (Fleutiaux 4): Mountain Province, Baguio (Williams, June); Mount Data, 5,000 feet (Hadden, May; Fleutiaux det.): Manila (Schultze 15). *NEGROS, Occidental Negros Province (Williams, September).

16. ADELOCERA (COMPSOLACON) DORCINA (Candèze).

Lacon dorcina CANDÈZE, Bull. Soc. ent. Belg. (1875) 119.

BOHOL (type locality). MINDANAO, Zamboanga Province, Dapitan (Fleutiaux 5); Kabasalan (Muzzall, March): Bukidnon Province, Santa Fe (Phillips); Diklom, 2,000 to 3,000 feet (Phillips, March to May). *NEGROS, Oriental Negros Province, Dumaguete (Williams, April; Fleutiaux det.).

17. ADELOCERA (COMPSOLACON) INTERMEDIA (Schwarz).

Lacon intermedia SCHWARZ, Stett. Ent. (1902) 199.

CEBU, Toledo (Schultze 15). LUZON, Tayabas Province, Baler (Schultze 15).

Described from Sumatra and North Borneo.

18. ADELOCERA (COMPSOLACON) LOPEZI Fleutiaux.

Adelocera (*Compsolacon*) *lopezi* FLEUTIAUX, Proc. Haw. Ent. Soc. 8 (1934) 477.

NEGROS, Occidental Negros Province, La Carlota (Lopez, June) (type locality).

19. ADELOCERA (ARCHONTAS) MACGREGORI Fleutiaux.

Adelocera (*Archontas*) *macgregori* FLEUTIAUX, Bull. et Ann. Soc. ent. Belg. 74 (1934) 364.

PANAY (McGregor) (type locality).

20. ADELOCERA (ADELOCERA) MOLITOR (Candèze).

Lacon molitor CANDÈZE, Bull. Soc. ent. Belg. (1875) 119.

MINDANAO, southwest coast (type locality): Bukidnon Province, Santa Fe, Diklom, 2,000 to 3,000 feet (Philips, March–May): Zamboanga Province, Kabasalan (Muzzall, March). PALAWAN, Iwahig, Bacuit (Schultze 15).

Found very numerous at Diklom by Phillips.

21. ADELOCERA (COMPSOLACON) SPURCA (Candèze).

Lacon spurca CANDÈZE, Elat. nouv., fasc. 1 (1865) 11.

LUZON (type locality): Mountain Province, Camp 82, 6,000 feet (Hadden, May; Fleutiaux det.); Mount Data, 5,000 feet (Hadden, May); Mount Santo Tomas, 6,000 feet (Hadden, May): Tayabas Province, Malinao (Fleutiaux 5).

22. ADELOCERA (COMPSOLACON) SUBCERVINA (Fleutiaux).

Lacon subcervina FLEUTIAUX, Philip. Journ. Sci. § D 11 (1916) 219.

LUZON, Bataan Province, Mount Limay (type locality): Pangasinan Province, Asingan (Hadden, May; Fleutiaux det.).

Genus MERISTHUS Candèze

23. MERISTHUS NIGRITULUS Candèze.

Meristhus nigritulus CANDÈZE, Elat. nouv., fasc. 5 (1893) 10.

LUZON, Laguna Province, Los Baños (Fleutiaux 4). Originally described from Sumatra.

Genus BRACHYLACON Motschulsky

24. BRACHYLACON MICROCEPHALUS Motschulsky.

Brachylacon microcephalus MOTSCHULSKY, Etud. Ent. 7 (1858) 60.
Lacon trifasciatus CANDÈZE.
Lacon difficilis LEWIS.

LUZON, Laguna Province, Los Baños (Schultze 15); Mount Maquiling (Fleutiaux 5). MINDANAO, Agusan Province, Butuan (Fleutiaux 5). PALAWAN (Fleutiaux 7).

This species was originally described from Ceylon and is known to range throughout the Indomalayan Region to southern Japan.

Hadden took this beetle in great numbers on Mount Maquiling, at 400 to 2,000 feet, in June, under dead bark. There also he took a specimen from "bolon" (*Alphonsea arborea*) in November, and others in June and July on the flowers of "sakat" (*Terminalia nitens*) and of "molave" (*Vitex parviflora*). Among the Mount Maquiling specimens are several considerably smaller than the typical forms, but despite their size Fleutiaux considers them the same species.

25. BRACHYLACON OBLONGUS Fleutiaux.

Brachylacon oblongus FLEUTIAUX, Bull. et Ann. Soc. ent. Belg. 74 (1934) 365.

LUZON, Manila (type locality).

Genus TRACHYLACON Motschulsky

26. TRACHYLACON BAKERI Fleutiaux.

Trachylacon bakeri FLEUTIAUX, Ann. Soc. ent. France (1935) 14.

LUZON, Nueva Vizcaya Province, Imugan (type locality) (Baker).

26. 1. TRACHYLACON LUZONICUS Fleutiaux.

Trachylacon luzonicus FLEUTIAUX, Ann. Soc. ent. France (1935) 17.

LUZON, Tayabas Province, Mount Banahao.

Genus AGRAEUS Candèze

27. AGRAEUS MANNERHEIMI Candèze.

Agraeus mannerheimi CANDÈZE, Mon. des Elat. 1 (1857) 166, pl. 3, fig. 4.
Agraeus ritsemae CANDÈZE (male).

*LUZON, Laguna Province, Mount Maquiling, 400 feet (Hadden, June; Fleutiaux det.). * NEGROS, Oriental Negros Province, Cuernos Mountains (Baker; Fleutiaux collection).

Hitherto known only from Java and Sumatra.

Genus ALAUS Eschscholtz

28. ALAUS BREVIPENNIS Candèze.

Alaus brevipennis CANDÈZE, Bull. Soc. ent. Belg. (1875) 120.

BABUYANES (type locality). BOHOL (type locality). LUZON (eastern) (type locality): Tayabas Province, Mount Banahao (Cornell collection). MINDANAO (Schultze 15), Bukidnon Province, Santa Fe, 2,000 feet (Phillips, June): Zamboanga Province, Tambanan (Muzzall, June; Fleutiaux det.).

29. ALAUS FARINULENTUS Fleutiaux.

Alaus farinulentus FLEUTIAUX, Proc. Haw. Ent. Soc. 8 (1934) 478.

LUZON, Mountain Province, Mount Data, 5,000 feet (Hadden, May); Mount Santo Tomas, 6,000 feet (Hadden, May) (both type localities).

30. ALAUS LACTEUS (Fabricius).

Elater lacteus FABRICIUS, Syst. El. 2 (1801) 230.

*LUZON, Laguna Province, Pangil (Hadden, May). MINDANAO (Candèze 2).

Originally known from Borneo and Sumatra. The variety mentioned by Candèze (2: p. 120) from Mindanao is *pantherinus* Candèze, in Fleutiaux's opinion.

ALAUS MODIGLIANI Candèze.

Alaus modigliani CANDÈZE, Ann. Mus. Genova II 12 (1892) 797.

Schultze (15) records from Sibuyan this species, which is otherwise known only from Engano Island, south of Sumatra. Its presence in the Philippines is doubtful.

31. ALAUS NEBULOSUS Candèze.

Alaus nebulosus CANDÈZE, Mon. des Elat. 1 (1857) 232.

BOHOL (Schultze 15). LEYTE (Schultze 15). LUZON, Camarines Sur Province, Iriga (Hadden, June): Laguna Province, Los Baños (Hadden, October); Mount Maquiling, bred from wood of *Ficus minahassæ* and of *Artocarpus blancoi* (Hadden, February, July, November, and December); Pangil (Hadden, May to July): Mountain Province, Mount Polis, Ifugao, 3,000 feet (Hadden, July): Nueva Vizcaya Province, Imugan (Cornell collection): Manila (type locality): Tayabas Province, Mount Banahao (Fleutiaux 5). * MASBATE, Aroroy (Cornell collec-

tion). MINDANAO (Candèze 2), Bukidnon Province, Diklom, 3,000 feet (Phillips, March): Surigao Province (Cornell collection).

Apparently a rather common species on Luzon.

32. ALAUS PANTHERINUS Candèze.

Alaus pantherinus CANDÈZE, Elat. nouv., fasc. 3 (1881) 16.

*LUZON, Tayabas Province, Mount Banahao (Baker; Fleutiaux collection). MINDANAO (type locality). * PALAWAN (Waterstradt; Fleutiaux collection).

33. ALAUS PODARGUS Candèze.

Alaus podargus CANDÈZE, Rev. des Elat. (1874) 125.

BOHOL (Candèze 2). LUZON (type locality), Ambos Camarines Province, Mount Isarog (Fleutiaux collection): Laguna Province, Mount Maquiling (Fleutiaux collection); Pangil (Hadden, May): Tayabas Province, Quezon Park (Hadden). *MASBATE, Aroroy (Fleutiaux collection). * MINDANAO, Agusan Province, Santiago (Phillips, April; Fleutiaux det.).

What is probably this same species is in the Fleutiaux collection from Sibuyan Island (Baker).

34. ALAUS SCYTALE Candèze.

Alaus scytale CANDÈZE, Mon. des Elat. 1 (1857) 228.

LUZON (Candèze 2), Laguna Province, Los Baños, from shallow boring in dead twig of *Ficus indica* (Williams, April); Mount Maquiling, on flowers of "molave" (*Vitex parviflora*) (Hadden, July); San Antonio (Schultze 15): Tayabas Province, Quezon Park (Hadden, May). *MINDANAO, Bukidnon Province, Diklom, 3,000 feet (Phillips, March; Fleutiaux det.); Santa Fe 2,000 feet (Phillips, June).

Known also from Celebes and New Guinea.

35. ALAUS SEMPERI Candèze.

Alaus semperi CANDÈZE, Ann. Soc. ent. Belg. (1875) 120.

MINDANAO, east coast (type locality): Bukidnon Province, Santa Fe, 2,000 feet (Phillips, June). *SAMAR (*Baker 20967, 23148;* Fleutiaux collection).

36. ALAUS SUPERBUS Candèze.

Alaus superbus CANDÈZE, Ann. Soc. ent. Belg. (1875) 120.

*LUZON, Bataan Province, Mount Limay (Baker; Fleutiaux collection): Nueva Vizcaya Province, Imugan (Fleutiaux collection). MINDANAO, east coast (type locality).

Genus EUMOEUS Candèze

37. EUMOEUS BAKERI (Fleutiaux).

Tharopsides bakeri FLEUTIAUX, Bull. Mus. Paris (1818) 236, footnote.

*LUZON, Laguna Province, Mount Maquiling (Hadden, May; Fleutiaux det.). MINDANAO, Zamboanga (Baker) (type locality).

The change of generic name is by Fleutiaux, in correspondence.

Genus EUMOEUS Candèze

38. TETRIGUS FLABELLATUS (Germar).

Aphanobius flabellatus GERMAR, Zeit. Ent. 5 (1844) 186.

*LUZON, Laguna Province, Mount Maquiling (Hadden, June; Fleutiaux det.).

Described from Java.

Genus CAMPSOSTERNUS Latreille

39. CAMPSOSTERNUS ESCHSCHOLTZI Hope.

Campsosternus eschscholtzi HOPE, Trans. Ent. Soc. London 3 (1843) 292.

LUZON, Manila (type locality).

Some of the earlier references to "Manila," this one possibly included, are undependable; the name was sometimes used loosely for the entire Archipelago.

40. CAMPSOSTERNUS PROTEUS Hope.

Campsosternus proteus HOPE, Trans. Ent. Soc. London 3 (1843) 291.

LUZON, Manila (type locality) (Schultze 15).

41. CAMPSOSTERNUS RUTILANS Chevrolat.

Campsosternus rutilans CHEVROLAT, Rev. Zool. (1841) 22.

LUZON, Laguna Province, Agricultural College (Hadden, June); Mount Maquiling, 400 feet (Hadden, May).

Known also from the Sunda Islands; apparently common in the Mount Maquiling region.

41a. CAMPSOSTERNUS RUTILANS var. SUMPTUOSUS Hope.

Campsosternus rutilans var. *sumptuosus* HOPE, Trans. Ent. Soc. London 3 (1843) 228.

LUZON, Bataan Province, Lamao (Schultze 15): Manila (type locality). *MINDANAO, Bukidnon Province, Santa Fe, 2,000 feet (Phillips, June; Fleutiaux det.). PALAWAN, Iwahig (Schultze 15).

This variety is doubtfully present in Java.

41b. CAMPSOSTERNUS RUTILANS Chevrolat var.

LUZON, Rizal Province, Novaliches (Hadden, May; Fleutiaux det.).

This variety is blackish.

Genus OXYNOPTERUS Hope

42. OXYNOPTERUS AUDOUINI Hope.

Oxynopterus audouini HOPE, Proc. Zool. Soc. London (1842) 77.

LUZON, Laguna Province, Los Baños (Schultze 15); Mount Maquiling (Hadden): Manila (Schultze 15): Rizal Province, Novaliches (Hadden): Tayabas Province, Mount Banahao (Fleutiaux 5); Quezon Park (Hadden). PALAWAN, Iwahig (Schultze 15).

Hadden took this beetle in flight in the late afternoon on Mount Maquiling, and at lights at night. Of twenty-three specimens so taken in January, March to August, and November at Novaliches, Quezon Park, Los Baños, and Mount Maquiling, all but two are males.

I am indebted to Mr. Fleutiaux for the following synonymy distribution of the species of this genus:

Oxynopterus mucronatus Olivier (*flabellicornis* Castelnau; *javanus* Hope); Java.
Oxynopterus audouini Hope (*cumingi* Hope); Philippines.
Oxynopterus candezei Fleutiaux (*audouini* Candèze, nec Hope); Penang; Sumatra.
Oxynopterus harmandi Fleutiaux; Cochin China; Laos.
Oxynopterus harmseni Candèze; Sumatra.
Oxynopterus annamensis Fleutiaux; Annam.

Genus PROPSEPHUS Hyslop

43. PROPSEPHUS INCAUTUS (Candèze).

Psephus incautus CANDÈZE, Elat. nouv., fasc. 6 (1896) 26.

BALABAC (type locality).

44. PROPSEPHUS ORIENTALIS (Candèze).

Psephus orientalis CANDÈZE, Elat. nouv., fasc. 7 (1900) 7.

Philippine Islands (type locality).

45. PROPSEPHUS PHILIPPINENSIS (Candèze).

Psephus philippinensis CANDÈZE, Bull. Soc. ent. Belg. (1875) 121.

BOHOL (type locality).

Genus SPHENOMERUS Candèze

46. SPHENOMERUS BAKERI (Fleutiaux).

Dicronychus bakeri FLEUTIAUX, Philip. Journ. Sci. § D 9 (1914) 449.

LUZON, Laguna Province, Mount Maquiling (type locality).

A specimen in the Hadden collection was taken on Mount Maquiling at 400 feet in October, and another in August. The generic synonymy is Fleutiaux's, in correspondence.

Genus SIMODACTYLUS Candèze

47. SIMODACTYLUS CINNAMOMEUS (Boisduval).

Aeolus cinnamomeus BOISDUVAL, Faune Oceanie, Coleop. (1835) 106.

? MINDANAO.

Candèze (2) mentions a single specimen taken in the Philippines by Semper, most of whose collecting was in Mindanao. The species is widespread throughout Oceania.

48. SIMODACTYLUS LUZONICUS Fleutiaux.

Simodactylus luzonicus FLEUTIAUX, Bull. et Ann. Soc. ent. Belg. 74 (1934) 365.

LUZON, Tayabas Province, Mount Banahao (type locality).

49. SIMODACTYLUS PHILIPPINENSIS Fleutiaux.

Simodactylus philippinensis FLEUTIAUX, Bull. et Ann. Soc. ent. Belg. 74 (1934) 366.

MINDANAO, Surigao Province (Baker) (type locality).

50. SIMODACTYLUS PULCHERRIMUS Candèze.

Simodactylus pulcherrimus CANDÈZE, Elat. nouv., fasc. 4 (1889) 89.

LUZON, Tayabas Province (type locality).

SIMODACTYLUS TASMANI Candèze.

Simodactylus tasmani CANDÈZE, Elat. nouv., fasc. 5 (1893) 24.

Fleutiaux doubtfully identifies as this species a specimen taken in Occidental Negros (Williams, September). The species was described from the Fiji Islands.

Genus MONOCREPIDIUS Eschscholtz

51. MONOCREPIDIUS PHILIPPINENSIS Fleutiaux.

Monocrepidius philippinensis FLEUTIAUX, Philip. Journ. Sci. § D 11 (1916) 221.

LUZON, Tayabas Province, Mount Banahao (type locality).

Whether or not *Monocrepidius* should be reduced to a subgenus under *Conoderus* is perhaps a matter of individual opinion.

52. MONOCREPIDIUS HADDENI Fleutiaux.

Monocrepidius haddeni FLEUTIAUX, Philip. Journ. Sci. 49 (1932) 567.

LUZON, Laguna Province (Hadden) (type locality).

Genus HETERODERES Latreille

53. HETERODERES MALAISIANUS Candèze.

Heteroderes malaisianus CANDÈZE, Mon. des Elat. 2 (1859) 359.

*MINDANAO, Zamboanga Province, Kabasalan (Muzzall, May and June; Fleutiaux det.).

Originally described from Java; this insect occurs throughout the Malay Archipelago eastward as far as Timor.

54. HETERODERES PALLIDUS Fleutiaux.

Heteroderes pallidus FLEUTIAUX, Proc. Haw. Ent. Soc. 8 (1934) 478.

LUZON, Laguna Province, Los Baños (Muir) (type locality). Described from a single specimen.

55. HETERODERES PROSTERNALIS (Candèze).

Drasterius prosternalis CANDÈZE, Elat. nouv., fasc. 2 (1878) 26.
Heteroderes drasteroides FLEUTIAUX.

LUZON, Laguna Province, Los Baños (Fleutiaux 4).

Originally described from India; it is known also from Burma, Indo-China, Java, Sumatra, Borneo, and China.

56. HETERODERES TRIANGULARIS (Eschscholtz).

Elater triangularis ESCHSCHOLTZ, Entomogr. 1 (1822) 73.

LUZON, Laguna Province, Los Baños (Muir): Manila, light trap (Hadden, June). *NEGROS, Occidental Negros Province, La Carlota (Lopez; Fleutiaux det.).

Originally described from the Philippines; this species has a wide range throughout the Malay Archipelago and Indo-China.

Genus AEOLODERMA Fleutiaux

57. AEOLODERMA BRACHMANA (Candèze).

Aeolus brachmana CANDÈZE, Mon. des Elat. 2 (1859) 345.
Heteroderes multilineatus CANDÈZE.
Heteroderes beccarii CANDÈZE.

LEYTE, Tacloban (Fleutiaux 5). LUZON, Laguna Province, Los Baños (Fleutiaux 4); Mount Maquiling (Hadden, August): Manila (Schultze 15): Rizal Province, Montalban (Schultze 15).

Occurs from Ceylon to Formosa. The synonymy is according to Fleutiaux [Ann. Soc. ent. France (1905) 21, and Faune ent. de l'Indochine, No. 2 (June, 1924) Elateridæ 75], who considers *beccarii* and *multilineatus* to be only local races of this extremely variable species.

58. AEOLODERMA MINUSCULUS (Candèze).

Heteroderes minusculus CANDÈZE, Elat. nouv., fasc. 2 (1878) 23.

Philippine Islands (type locality).

Genus PRODRASTERIUS Fleutiaux

59. PRODRASTERIUS INSULARIS (Candèze).

Drasterius insularis CANDÈZE, Bull. Soc. ent. Belg. (1875) 121.

BOHOL (type locality).

60. PRODRASTERIUS SULCATULUS (Candèze).

Drasterius sulcatulus CANDÈZE, Mon. des Elat. 2 (1859) 427.

LUZON, Laguna Province, Los Baños (Fleutiaux 4): Manila (Fleutiaux collection).

The type locality is East Indies; known also from Sumatra and India.

Genus ELATER Linnæus

61. ELATER CONSPURCATUS Candèze.

Elater conspurcatus CANDÈZE, Elat. nouv., fasc. 4 (1889) 34.
Megapenthes cinctus FLEUTIAUX.

LUZON, Laguna Province, Mount Maquiling, 400 feet (Hadden, June; Fleutiaux det.): Tayabas Province, Dolores (type locality).

Genus MEGAPENTHES Kiesenwetter

62. MEGAPENTHES ANGULOSUS Candèze.

Megapenthes angulosus CANDÈZE, Bull. Soc. ent. Belg. (1875) 122.

LUZON, Laguna Province, Los Baños (Williams, June and July; Fleutiaux det.). MINDANAO (type locality).

63. MEGAPENTHES ANGUSTUS Fleutiaux.

Megapenthes angustus FLEUTIAUX, Proc. Haw. Ent. Soc. 8 (1932) 48.

Luzon, Laguna Province, Mount Maquiling (Hadden, April and May) (type locality).

Hadden also took this beetle on Mount Maquiling at 400 feet in June and July, and at 3,000 feet on flowers of "santan puti" (*Ixora finlaysoniana*) in July.

64. MEGAPENTHES BAKERI Fleutiaux.

Megapenthes bakeri FLEUTIAUX, Bull. et Ann. Soc. ent. Belg. 74 (1934) 368.

MINDANAO, Lanao Province, Kolambugan. SAMAR (Baker) (type locality).

MEGAPENTHES CINCTUS Fleutiaux.

Megapenthes cinctus FLEUTIAUX, Philip. Journ. Sci. 49 (1932) 567.

Referred to *Elater conspurcatus* Candèze by Fleutiaux, Bull. Soc. ent. France 38 (1933) 114.

65. MEGAPENTHES CONGESTUS Candèze.

Megapenthes congestus CANDÈZE, Elat. nouv., fasc. 6 (1896) 42.

BALABAC (type locality).

66. MEGAPENTHES DIPLOCONOIDES Candèze.

Megapenthes diploconoides CANDÈZE, Bull. Soc. ent. Belg. (1875) 122.

Philippine Islands (type locality); possibly Mindanao.

67. MEGAPENTHES FRONTALIS Fleutiaux.

Megapenthes frontalis FLEUTIAUX, Proc. Haw. Ent. Soc. 8 (1932) 47.

LUZON, Laguna Province, Los Baños (Pemberton, March to June); Mount Maquiling, 2,000 feet (Hadden, April) (type locality); Pangil (Hadden, May): Mountain Province, Baguio (Williams, June).

68. MEGAPENTHES FULVUS Fleutiaux.

Megapenthes fulvus FLEUTIAUX, Philip. Journ. Sci. § D 9 (1914) 443.

LUZON, Ambos Camarines Province, Mount Isarog (Cornell collection): Laguna Province, Los Baños and Mount Maquiling, 2,000 feet (Hadden, June) (type localities); Pangil (Hadden, May): Nueva Vizcaya Province, Imugan (Cornell collection): Tayabas Province, Mount Banahao (Cornell collection). *MINDANAO, Bukidnon Province, Diklom, 3,000 feet (Phillips, April): Zamboanga Province, Kabasalan (Muzzall, April; Fleutiaux det.).

69. MEGAPENTHES HADDENI Fleutiaux.

Megapenthes haddeni FLEUTIAUX, Proc. Haw. Ent. Soc. 8 (1934) 481.

LUZON, Laguna Province, Mount Maquiling (Hadden, April) (type locality): Tayabas Province, Mount Banahao (Cornell collection).

70. MEGAPENTHES INCONDITUS Candèze.

Megapenthes inconditus CANDÈZE, Bull. Soc. ent. Belg. (1875) 122.

All the islands (Candèze 2). LUZON, Laguna Province, Los Baños (Fleutiaux 4); Mount Maquiling (Fleutiaux 5): Tayabas Province, Malinao and Mount Banahao (Fleutiaux 5). PALAWAN, Puerto Princesa (Fleutiaux 5).

Apparently common on Mount Maquiling throughout the year. Known also from Celebes.

71. MEGAPENTHES INFLATUS Candèze.

Megapenthes inflatus CANDÈZE, Bull. Soc. ent. Belg. (1875) 122.

Babuyanes (type locality). LUZON, Ambos Camarines Province, Mount Isarog (Cornell collection): Laguna Province, Los Baños (Pemberton, March to June); Mount Maquiling, on flowers of *Terminalia nitens* and of *Vitex parviflora* (Hadden, June); Pangil (Hadden, May): Manila (Cornell collection): Tayabas Province, Mount Banahao (Fleutiaux 5). *MINDANAO, Bukidnon Province, Diklom, 3,000 feet (Phillips, April).

72. MEGAPENTHES JUNCEUS Candèze.

Megapenthes junceus CANDÈZE, Elat. nouv., fasc. 1 (1865) 30.

LUZON, Camarines Sur Province, Iriga (Hadden collection, July): Laguna Province, Mount Maquiling, 2,000 to 3,000 feet, on flowers of *Clethra lancifolia* (Hadden, April to June): Manila (type locality): Tayabas Province, Mount Banahao (Fleutiaux 5). MINDANAO, Agusan Province, Butuan (Fleutiaux 5): Bukidnon Province, Diklom, 3,000 feet (Phillips, March): Surigao Province (Cornell collection).

This species is known also from Borneo, Java, and Burma.

72a. MEGAPENTHES JUNCEUS var. CANDÈZEI Fleutiaux.

Megapenthes junceus var. *candèzei* FLEUTIAUX, Philip. Journ. Sci. § D 9 (1914) 442.

LUZON, Laguna Province, Mount Maquiling (type locality).

73. MEGAPENTHES LEWISI Fleutiaux.

Glyphonyx ornatus FLEUTIAUX, Philip. Journ. Sci. § D 9 (1916) 233; not *Megapenthes ornatus* Lewis, 1894.

LUZON, Laguna Province, Mount Maquiling: Tayabas Province, Mount Banahao (type localities).

The change in generic name was made by Fleutiaux in correspondence; the Japanese *Megapenthes ornatus* Lewis, 1894, has priority.

MEGAPENTHES LIGATUS (Candèze).

Melanoxanthus ligatus CANDÈZE, Ann. Mus. Genova (1878) 124.

Fleutiaux (9, part 2, p. 166) records specimens from the Philippines that are very close to the typical form from Borneo.

74. MEGAPENTHES LUZONICUS Fleutiaux.

Megapenthes luzonicus FLEUTIAUX, Philip. Journ. Sci. § D 9 (1914) 442.

LUZON, Laguna Province, Los Baños (Schultze 15); Mount Maquiling (type locality): Tayabas Province, Mount Banahao (Fleutiaux 5).

75. MEGAPENTHES MACERATUS Candèze.

Megapenthes maceratus CANDÈZE, Elat. nouv., fasc. 6 (1896) 42.

BALABAC (type locality). * MINDANAO, Bukidnon Province, Diklom, 3,000 feet (Phillips, March; Fleutiaux det.).

76. MEGAPENTHES MAGNUS Fleutiaux.

Megapenthes magnus FLEUTIAUX, Proc. Haw. Ent. Soc. 8 (1934) 482.

LUZON, Mountain Province, Camp 82, 6,000 feet (Hadden, May) (type locality).

Described from a single specimen.

77. MEGAPENTHES NIGRICORNIS Candèze.

Megapenthes nigricornis CANDÈZE, Bull. Soc. ent. Belg. (1875) 123.

LUZON (type locality).

78. MEGAPENTHES OPACIPENNIS Candèze.

Megapenthes opacipennis CANDÈZE, Bull. Soc. ent. Belg. (1875) 122.

* LUZON, Mountain Province, Mount Santo Tomas, 6,000 feet (Hadden, May; Fleutiaux det.).

No locality was named for Candèze's material; Hadden's taking of this species appears to be the first since it was described.

79. MEGAPENTHES ORNATICOLLIS Fleutiaux.

Megapenthes ornaticollis FLEUTIAUX, Proc. Haw. Ent. Soc. 8 (1934) 481.

MINDANAO, Bukidnon Province, Diklom, 3,000 feet (Phillips, March) (type locality).

Described from a single specimen.

80. MEGAPENTHES PHILIPPINENSIS Fleutiaux.

Megapenthes philippinensis FLEUTIAUX, Proc. Haw. Ent. Soc. 8 (1932) 48.

LUZON, Laguna Province, Mount Maquiling, 3,000 feet, on flowers of "malaklak" (*Clethra lancifolia*) (Hadden, April) (type locality).

Genus MELANOXANTHUS Eschscholtz

81. MELANOXANTHUS ACUTIFRONS Fleutiaux.

Melanoxanthus acutifrons FLEUTIAUX, Proc. Haw. Ent. Soc. 8 (1934) 480.

LUZON, Laguna Province, Mount Maquiling, 2,000 feet (Hadden, June) (Ladrera, March) (type locality).

82. MELANOXANTHUS AFFINIS Fleutiaux.

Melanoxanthus affinis FLEUTIAUX, Philip. Journ. Sci. § D 9 (1914) 444.

LUZON, Laguna Province, Mount Maquiling, 400 feet on flowers of *Clethra lancifolia*, 3,000 feet on flowers of *Ixora finlaysoniana* (Hadden, July) (type locality): Tayabas Province, Mount Banahao (Feutiaux 5). MINDANAO, Agusan Province, Butuan (Fleutiaux 5).

83. MELANOXANTHUS APPROXIMATUS Candèze.

Melanoxanthus approximatus CANDÈZE, Bull. Soc. ent. Belg. (1875) 123.

ALABAT (type locality). LUZON, Laguna Province, Los Baños (Schultze 15); Mount Maquiling (Fleutiaux 5): Tayabas Province, Quezon Park (Hadden, May).

84. MELANOXANTHUS ATER Fleutiaux.

Melanoxanthus ater FLEUTIAUX, Philip. Journ. Sci. § D 9 (1914) 445.

LUZON, Laguna Province, Los Baños (type locality); Mount Maquiling, up to 3,000 feet, on flowers of *Terminalia nitens*, of *Vitex parviflora*, and of *Ehretia philippinensis* (Hadden, May and June): Tayabas Province, Mount Banahao (Fleutiaux 5).

85. MELANOXANTHUS BAKERI Fleutiaux.

Melanoxanthus bakeri FLEUTIAUX, Philip. Journ. Sci. § D 9 (1914) 443.

LUZON, Laguna Province, Agricultural College (Williams and Pemberton, June); Los Baños (type locality); Mount Maquiling, up to 3,000 feet (Hadden, May); Pangil (Hadden, May): Tayabas Province, Mount Banahao (Cornell collection).

A fairly common species in Laguna on flowers of "sakat" (*Terminalia nitens*) and of *Ehretia philippinensis*.

86. MELANOXANTHUS BASALIS Fleutiaux.

Melanoxanthus basalis FLEUTIAUX, Proc. Haw. Ent. Soc. 8 (1934) 479.

LUZON, Laguna Province, Mount Maquiling (Hadden, May) (type locality).

Described from a single specimen.

87. MELANOXANTHUS BICINCTUS Fleutiaux.

Melanoxanthus bicinctus FLEUTIAUX, Philip. Journ. Sci. § D 11 (1916) 226.

NEGROS, Cuernos Mountains (type locality).

88. MELANOXANTHUS BILINEATUS Fleutiaux.

Melanoxanthus bilineatus FLEUTIAUX, Proc. Haw. Ent. Soc. 8 (1934) 480.

LUZON, Laguna Province, Mount Maquiling (Hadden, March and June) (type locality).

89. MELANOXANTHUS BIPARTITUS Candèze.

Melanoxanthus bipartitus CANDÈZE, Bull. Soc. ent. Belg. (1875) 128.

* MASBATE, Aroroy (Cornell collection). MINDANAO (type locality), Surigao Province (Cornell collection).

90. MELANOXANTHUS BITRIPLEX Candèze.

Melanoxanthus bitriplex CANDÈZE, Elat. nouv., fasc. 6 (1896) 43.

LUZON, Laguna Province, Mount Maquiling, on flowers of *Terminalia nitens* (Hadden, June; Fleutiaux det.): Tayabas Province, Malinao (Fleutiaux 5). MINDANAO, Agusan Province, Butuan (Fleutiaux 5): Zamboanga Province, Kabasalan, on flowers (Muzzall), August).

Originally described from Banguey, a small island north of Borneo; it is known also from Borneo, Celebes, and Sumatra.

91. MELANOXANTHUS BUTUANUS Fleutiaux.

Melanoxanthus butuanus FLEUTIAUX, Philip. Journ. Sci. § D 11 (1916) 226.

MINDANAO, Agusan Province, Butuan (type locality).

92. MELANOXANTHUS CINCTUS Fleutiaux.

Melanoxanthus cinctus FLEUTIAUX, Philip. Journ. Sci. § D 11 (1916) 224.

LUZON, Laguna Province, Mount Maquiling (type locality); Pangil (Hadden, May): Mountain Province, Baguio ("Bacio") (Cornell collection): Nueva Vizcaya Province, Imugan (Cornell collection): Tayabas Province, Mount Banahao (type locality).

Hadden took this species at lower elevations on Mount Maquiling in June on flowers of "sakat," and higher, at 3,000 feet, in July on flowers of "santan puti" and of "molave;" in November on flowers of "kosibeng" (*Sapindus saponaria*).

93. MELANOXANTHUS COMES Candèze.

Melanoxanthus comes CANDÈZE, Elat. nouv., fasc. 6 (1896) 43.

BALABAC (type locality).

94. MELANOXANTHUS CRUCIFER Fleutiaux.

Melanoxanthus crucifer FLEUTIAUX, Philip. Journ. Sci. § D 9 (1914) 445.

LUZON, Laguna Province, Los Baños (type locality); Mount Maquiling (Hadden, June). MINDANAO, Agusan Province

(Fleutiaux 5): Lanao Province, Iligan (Fleutiaux 5). PALAWAN, Puerto Princesa (Fleutiaux 5).

95. MELANOXANTHUS DECEMGUTTATUS Candèze.

Melanoxanthus decemguttatus CANDÈZE, Bull. Soc. ent. Belg. (1875) 124.

MINDANAO (type locality).

96. MELANOXANTHUS EXCLAMATIONIS Candèze.

Melanoxanthus exclamationis CANDÈZE, Bull. Soc. ent. Belg. (1875) 123.

LUZON (type locality), Laguna Province, Agricultural College (Hadden, June); Mount Maquiling, up to 2,000 feet on flowers of *Terminalia nitens*, of *Ehretia philippinensis*, and of *Vitex parviflora* (Hadden, May to July): Tayabas Province, Mount Banahao (Cornell collection).

97. MELANOXANTHUS FINITIMUS Fleutiaux.

Melanoxanthus finitimus FLEUTIAUX, Philip. Journ. Sci. 49 (1932) 566.

LUZON, Laguna Province, Mount Maquiling (Hadden, January) (type locality).

Besides the type, Hadden took a small series at 2,000 feet on Mount Maquiling in June and July, on flowers of *Terminalia nitens* and of *Vitex parviflora*.

98. MELANOXANTHUS GRANDIS Fleutiaux.

Melanoxanthus grandis FLEUTIAUX, Bull. et Ann. Soc. ent. Belg. 74 (1934) 367.

LUZON, Mountain Province, Baguio ("Bacio") (type locality).

99. MELANOXANTHUS HADDENI Fleutiaux.

Melanoxanthus haddeni FLEUTIAUX, Philip. Journ. Sci. 49 (1932) 565.

LUZON, Laguna Province, Mount Maquiling (Hadden, May) (type locality).

100. MELANOXANTHUS HEMIONUS Candèze.

Melanoxanthus hemionus CANDÈZE, Elat. nouv., fasc. 5 (1893) 38.

LUZON, Laguna Province, Calauang (Schultze 15); Los Baños (Schultze 15); Paete (Fleutiaux 5). MINDANAO (type locality). MINDORO, Baco River (Schultze 15).

Both Candèze and Fleutiaux consider that the Philippine records of *M. zebra* (Wiedemann), a Javan species, refer to this insect. Accordingly, I have included under *hemionus* all of Schultze's records of *zebra*.

101. MELANOXANTHUS ILLUSTRIS Fleutiaux.

Melanoxanthus illustris FLEUTIAUX, Philip. Journ. Sci. 18 (1921) 73.

MINDANAO, Davao Province (Baker) (type locality).

102. MELANOXANTHUS INFIMUS Candèze.

Melanoxanthus infimus CANDÈZE, Bull. Soc. ent. Belg. (1875) 124.

LUZON, Laguna Province, Los Baños (Fleutiaux 4). MINDANAO (type locality).

103. MELANOXANTHUS INFUSCATUS Fleutiaux.

Melanoxanthus infuscatus FLEUTIAUX, Philip. Journ. Sci. § D 11 (1916) 225.

LUZON, Laguna Province, Los Baños (type locality); Mount Maquiling, 3,000 feet (Hadden, March and April; Fleutiaux det.).

104. MELANOXANTHUS INSIGNIS Fleutiaux.

Melanoxanthus insignis FLEUTIAUX, Philip. Journ. Sci. 18 (1921) 73.

MINDANAO, Davao Province (Baker) (type locality).

105. MELANOXANTHUS LATERALIS Fleutiaux.

Melanoxanthus lateralis FLEUTIAUX, Philip. Journ. Sci. 49 (1932) 566.

LUZON, Mountain Province, Baguio, 5,000 feet (Hadden, March) (type locality).

106. MELANOXANTHUS LONGICOLLIS Fleutiaux.

Melanoxanthus longicollis FLEUTIAUX, Proc. Haw. Ent. Soc. 8 (1934) 479.

MINDANAO, Bukidnon Province, Diklom, 2,000 feet (Phillips, March) (type locality).

Described from a single specimen.

107. MELANOXANTHUS LUZONICUS Fleutiaux.

Melanoxanthus luzonicus FLEUTIAUX, Philip. Journ. Sci. § D 9 (1914) 444.

LUZON, Laguna Province, Los Baños (type locality), Mount Maquiling (Schultze 15).

108. MELANOXANTHUS MELANOCEPHALUS (Fabricius).

Elater melanocephalus FABRICIUS, Spec. Ins. 1 (1781) 272.

Listed from the Philippines by Candèze (2) without specific locality. BASILAN (Schultze 15). LUZON, Laguna Province, Mount Maquiling (Hadden, August): MANILA (Schultze 15). NEGROS, Occidental Negros Province, Maao (Schultze 15).

Widely distributed throughout the Tropics. I have seen a specimen from Sarawak in the collection of Mr. J. E. A. Lewis, of Kobe, Japan.

MELANOXANTHUS MILITARIS Fleutiaux.

Melanoxanthus militaris FLEUTIAUX, Philip. Journ. Sci. § D 11 (1916) 223.

See *Anchastus fischeri* nom. nov.

109. MELANOXANTHUS MINUTUS Candèze.

Melanoxanthus minutus CANDÈZE, Elat. nouv., fasc. 6 (1896) 44.

BALABAC (Schultze 15).

Originally described from Banguey, north of Borneo.

110. MELANOXANTHUS NITIDICOLLIS Fleutiaux.

Melanoxanthus nitidicollis FLEUTIAUX, Philip. Journ. Sci. § D 11 (1916) 223.

LUZON, Tayabas Province, Mount Banahao (type locality).

111. MELANOXANTHUS ORNATUS Fleutiaux.

Melanoxanthus ornatus FLEUTIAUX, Bull. et Ann. Soc. ent. Belg. 74 (1934) 367.

LUZON, Bataan Province, Mount Limay (Cornell collection): Nueva Vizcaya Province, Imugan (Cornell collection): Tayabas Province, Mount Banahao. MINDANAO, Davao. SIBUYAN (Baker). (All of the foregoing are type localities.)

112. MELANOXANTHUS PALLIATUS Candèze.

Melanoxanthus palliatus CANDÈZE, Ann. Mus. Genova II 12 (1892) 799.

LUZON (Schultze), Mountain Province, Baguio, 5,000 feet (Hadden, March; Fleutiaux det.).

Described from Engano, an island south of Sumatra.

113. MELANOXANTHUS PARVULUS Fleutiaux.

Melanoxanthus parvulus FLEUTIAUX, Proc. Haw. Ent. Soc. 8 (1934) 480.

LUZON, Laguna Province, Mount Maquiling (Hadden, April) (type locality).

Taken in large numbers in April at 3,000 feet on Mount Maquiling on flowers of *Clethra lancifolia* and of *Eugenia* sp.; a few were taken in July at the same locality on "santan puti" (*Ixora finlaysoniana*).

114. MELANOXANTHUS PHILIPPINENSIS Fleutiaux.

Melanoxanthus philippinensis FLEUTIAUX, Philip. Journ. Sci. § D 11 (1916) 223.

LUZON, Tayabas Province, Mount Banahao. MINDANAO, Agusan Province, Butuan (type localities).

115. MELANOXANTHUS PROMECUS Candèze.

Melanoxanthus promecus CANDÈZE, Elat. nouv., fasc. 1 (1865) 36.

LUZON, Laguna Province, Mount Maquiling (Hadden, April to June): Nueva Vizcaya Province, Imugan (Cornell collection): Manila (type locality): Tayabas Province, Quezon Park (Hadden, April to June).

115a. MELANOXANTHUS PROMECUS Candèeze var.

LUZON, Ambos Camarines Province, Mount Isarog (Cornell collection): Mountain Province, Mount Data, 5,000 feet (Hadden, March): Nueva Vizcaya Province, Imugan (Cornell collection).

A specimen from Mount Data, seen by Fleutiaux, and considered by him to be a variety of *promecus*, has the pronotum entirely red without median black maculation; similar specimens are in the Cornell collection.

116. MELANOXANTHUS RECREATUS Candèze.

Melanoxanthus recreatus CANDÈZE, Elat. nouv., fasc. 6 (1896) 46.

BALABAC (type locality).

117. MELANOXANTHUS RHOMBOIDALIS Candèze.

Melanoxanthus rhomboidalis CANDÈZE, Bull. Soc. ent. Belg. (1875) 123.

LUZON (type locality).

118. MELANOXANTHUS RIXOSUS Candèze.

Melanoxanthus rixosus CANDÈZE, Elat. nouv., fasc. 6 (1896) 45.

* LUZON, Laguna Province, Mount Maquiling (Hadden, January; Fleutiaux det.).

Originally described from Banguey Island.

MELANOXANTHUS SEXGUTTATUS Candèze.

Melanoxanthus sexguttatus CANDÈZE, Ann. Mus. Genova (1892) 799.

Without definite locality Schultze records this species from Luzon; it is otherwise known only from Engano. Its presence in the Philippines may be regarded as doubtful.

119. MELANOXANTHUS SEXTUS Candéze.

Melanoxanthus sextus CANDÈZE, Bull. Soc. ent. Belg. (1875) 124.

LUZON, Laguna Province, Mount Maquiling, 400 feet, on flowers of "sakat" (Hadden, March to July; Fleutiaux det.): Tayabas Province, Malinao (Fleutiaux 5). MINDANAO (type locality).

119a. MELANOXANTHUS SEXTUS Candèze var.

LUZON, Laguna Province, Mount Maquiling, 3,000 feet, under bark (Hadden, April; Fleutiaux det.), on flowers of *Ixora finlaysoniana* and of *Vitex parviflora* (Hadden, July).

The variety is smaller than the typical form and lacks the median black marking on the pronotum.

120. MELANOXANTHUS SINGULARIS Candèze.

Melanoxanthus singularis CANDÈZE, Elat. nouv., fasc. 6 (1896) 46.

BALABAC (type locality).

Known also from Borneo, Sumatra, and Indo-China.

121. MELANOXANTHUS SUBCYLINDRICUS Candèze.

Melanoxanthus subcylindricus CANDÈZE, Elat. nouv., fasc 1 (1865) 35.

* LUZON, Laguna Province, Mount Maquiling (Hadden, May; Fleutiaux det.).

Originally described from Batchian in the Moluccas.

122. MELANOXANTHUS TERMINATUS Candèze.

Melanoxanthus terminatus CANDÈZE, Bull. Soc. ent. Belg. (1875) 124.

LUZON (type locality), Tayabas Province, Mount Banahao (Cornell collection).

123. MELANOXANTHUS VICINUS Fleutiaux.

Melanoxanthus militaris FLEUTIAUX, Philip. Journ. Sci. § D 11 (1916) 225.

LUZON, Laguna Province, Mount Maquiling (type locality).

Hadden collected a series of this species on flowers of "malaklak" (*Clethra lancifolia*) on Mount Maquiling at 3,000 feet in April.

123a. MELANOXANTHUS VICINUS Fleutiaux var.

LUZON, Mountain Province, Baguio, 5,000 feet (Hadden, March; Fleutiaux det.); Mount Santo Tomas, 6,500 feet (Hadden, March).

MELANOXANTHUS ZEBRA (Wiedemann).

Elater zebra WIEDEMANN, Zool. Mag. 2 (1823) 107.

See *Melanoxanthus hemionus* Candèze.

Genus ANCHASTUS J. Leconte

124. ANCHASTUS FISCHERI nom. nov.

Melanoxanthus militaris FLEUTIAUX, Philip. Journ. Sci. § D 11 (1916) 223; not *Anchastus militaris* Candèze, 1881.

LUZON, Tayabas Province, Mount Banahao (type locality).

In correspondence (March, 1935) Fleutiaux states that this species is an *Anchastus*. The original specific name is preoccupied by *Anchastus militaris* Candèze, 1881, from the western United States. The new name proposed is in honor of Mr. Arthur F. Fischer, director of the Philippine Bureau of Forestry.

125. ANCHASTUS FULVUS Fleutiaux.

Anchastus fulvus FLEUTIAUX, Philip. Journ. Sci. § D 11 (1916) 227.

MINDANAO, Lanao Province, Iligan (type locality).

126. ANCHASTUS HADDENI Fleutiaux.

Anchastus haddeni FLEUTIAUX, Proc. Haw. Ent. Soc. 8 (1934) 482.

LUZON, Mountain Province, Mount Santo Tomas, 6,000 feet (Hadden, March) (type locality).

Described from a single specimen.

127. ANCHASTUS NITIDUS Candèze.

Anchastus nitidus CANDÈZE, Elat. nouv., fasc 2 (1878) 25.
Anchastus sericeus CANDÈZE.

* BASILAN (Baker). * MINDANAO, Agusan Province, Butuan (Baker): Misamis Province, Dapitan (Baker): Surigao Province, Surigao (Baker) (all in the Fleutiaux collection).

Originally described from Borneo. The possible synonymy is suggested by Fleutiaux.

128. ANCHASTUS PHILIPPINENSIS Fleutiaux.

Anchastus philippinensis FLEUTIAUX, Proc. Haw. Ent. Soc. 8 (1932) 47.

LUZON, Laguna Province, Mount Maquiling (Hadden, April) (type locality).

129. ANCHASTUS RUFANGULUS Candèze.

Anchastus rufangulus CANÈZE, Bull. Soc. ent. Belg. (1875) 121.

LUZON, Laguna Province, Los Baños (Pemberton, March to June); Mount Maquiling (Fleutiaux 5). MINDANAO (type locality), Agusan Province, Butuan (Fleutiaux 5): Lanao Province, Iligan (Fleutiaux 5).

130. ANCHASTUS SERICEUS Candèze.

Anchastus sericeus CANDÈZE, Elat. nouv., fasc. 1 (1865) 27.

* LUZON, Laguna Province, Mount Maquiling (Hadden, May; Fleutiaux det.). MINDANAO, Agusan Province, Butuan (Fleutiaux 5): Misamis Province, Dapitan (Fleutiaux 5).

Originally described from Sarawak.

131. ANCHASTUS SUTURALIS Fleutiaux.

Anchastus suturalis FLEUTIAUX, Philip. Journ. Sci. § D 11 (1916) 227.

MINDANAO, Agusan Province, Butuan (type locality).

132. ANCHASTUS UNICOLOR Candèze.

Anchastus unicolor CANDÈZE, Elat. nouv., fasc. 3 (1881) 61.

LUZON, Laguna Province, Los Baños (Fleutiaux 5); Mount Maquiling, 400 feet (Hadden, March and April): Tayabas Province, Mount Banahao (Fleutiaux 5). MINDANAO (type locality).

133. ANCHASTUS VITTATUS Fleutiaux.

Anchastus vittatus FLEUTIAUX, Philip. Journ. Sci. § D 9 (1914) 445.

LUZON, Laguna Province, Mount Maquiling (type locality). Hadden took this species on Mount Maquiling in April.

133a. ANCHASTUS VITTATUS var. BAKERI Fleutiaux.

Anchastus vittatus var. *bakeri* FLEUTIAUX, Philip. Journ. Sci. § D 11 (1916) 227.

LUZON, Laguna Province, Mount Maquiling (type locality).

134. ANCHASTUS VULNERATUS Candèze.

Anchastus vulneratus CANDÈZE, Elat. nouv., fasc. 2 (1878) 24; Elat. de l'Indochine Francaise, pt. 2 (1928) 144.

* BASILAN. * MINDANAO, Lanao Province, Kolambugan: Surigao Province, Surigao. * NEGROS, Oriental Negros Province, Cuernos Mountains (Baker). (All of the foregoing records are from the Fleutiaux collection.)

The species was described from Siam and is known also from Sumatra.

135. ANCHASTUS WILLIAMSI Fleutiaux.

Anchastus williamsi FLEUTIAUX, Proc. Haw. Ent. Soc. 8 (1934) 482.

NEGROS (Williams, September) (type locality).

Described from a single specimen.

Genus HYPNOIDUS Stephens

136. HYPNOIDUS (HYPDONUS) BAKERI Fleutiaux.

Hypnoidus (*Hypdonus*) *bakeri* FLEUTIAUX, Philip. Journ. Sci. § D 9 (1914) 446.

LUZON, Laguna Province, Mount Maquiling (type locality). Known also from Borneo.

Genus ARRHAPHES Candèze

137. ARRHAPHES HUMERALIS Fleutiaux.

Arrhaphes humeralis FLEUTIAUX, Bull. Mus. Paris (1930) 638.

LUZON (Baker) (type locality).
Additional type specimens were from Tonkin.

Genus HEMIRRHAPHES Candèze

138. HEMIRRHAPHES CANDÈZEI Fleutiaux.

Hemirrhaphes candèzei FLEUTIAUX, Philip. Journ. Sci. § D 11 (1916) 228.

LUZON, Laguna Province, Los Baños (Pemberton, March to June); Mount Maquiling (type locality), 2,000 feet (Hadden, June).
Known also from Banguey and Perak.

139. HEMIRRHAPHES CRUCIATUS Fleutiaux.

Hemirrhaphes cruciatus FLEUTIAUX, Philip. Journ. Sci. § D 11 (1916) 228.

LUZON, Laguna Province, Mount Maquiling (type locality).

Genus QUASIMUS Gozis

140. QUASIMUS HADDENI Fleutiaux.

Quasimus haddeni FLEUTIAUX, Proc. Haw. Ent. Soc. 8 (1934) 483.

BASILAN. LUZON, Mountain Province, Baguio (Williams, June) (Baker), 5,000 feet (Hadden, March); Mount Santo Tomas, 7,000 feet, sweeping (Hadden, March). MINDANAO, Misamis Province, Dapitan. (All of the foregoing are type localities.)

Genus CARDIOPHORUS Eschscholtz

141. CARDIOPHORUS ALVINI Fleutiaux.

Cardiophorus alvini FLEUTIAUX, Philip. Journ. Sci. § D 11 (1916) 230.

LUZON, Laguna Province, Mount Maquiling: Tayabas Province, Malinao (type localities).

142. CARDIOPHORUS BAKERI Fleutiaux.

Cardiophorus elegans CANDÈZE, Ann. Mus. Genova (1878) 132.
Cardiophorus bakeri FLEUTIAUX, Philip. Journ. Sci. § D 9 (1914) 446 (new name for *C. elegans* Candèze 1878, nec Solier 1851).

LUZON, Laguna Provinces, Los Baños (Fleutiaux 5).

Originally described from Celebes; it is known also from Amboina.

143. CARDIOPHORUS BANKSI Fleutiaux.

Cardiophorus banksi FLEUTIAUX, Philip. Journ. Sci. § D 11 (1916) 229.

LUZON, Laguna Province, Mount Maquiling. MINDANAO, Lanao Province, Iligan. PALAWAN, Puerto Princesa. (Type localities, all.)

144. CARDIOPHORUS FASCIATUS Candèze.

Cardiophorus fasciatus CANDÈZE, Bull. Soc. ent. Belg. (1875) 124.

LUZON (type locality).

145. CARDIOPHORUS INCONDITUS Candèze.

Cardiophorus inconditus CANDÈZE, Bull. Soc. ent. Belg. (1875) 125.

LUZON (type locality).

CARDIOPHORUS LIGNIPENNIS Candèze.

Cardiophorus lignipennis CANDÈZE, Elat. nouv., fasc. 4 (1889) 106.

Described from Ternate in the Moluccas and from Mindanao. In his 1891 catalogue Candèze omits reference to Mindanao, which may be a correction of the original citation.

146. CARDIOPHORUS LUZONICUS Eschscholtz.

Cardiophorus luzonicus ESCHSCHOLTZ, Thon. Arch. 2 (1829) 34.

"Manila" (type locality). LUZON (Schultze 5).

147. CARDIOPHORUS PALAWANUS Fleutiaux.

Cardiophorus palawanus FLEUTIAUX, Philip. Journ. Sci. § D 11 (1916) 229.

NEGROS, Cuernos Mountains. PALAWAN, Puerto Princesa. (Type localities.)

148. CARDIOPHORUS PHILIPPINUS Fleutiaux.

Cardiophorus philippinus FLEUTIAUX, Philip. Journ. Sci. § D 11 (1916) 229.

149. CARDIOPHORUS SPERNENDUS Candèze.

Cardiophorus spernendus CANDÈZE, Bull. Soc. ent. Belg. (1875) 125.

MINDANAO (type locality).

150. CARDIOPHORUS UNICOLOR Candèze.

Cardiophorus unicolor CANDÈZE, Bull. Soc. ent. Belg. (1875) 125.

BOHOL. LUZON. PANAY. "etc." (Type localities.)

150a. CARDIOPHORUS UNICOLOR var. STRIATUS Fleutiaux.

Cardiophorus unicolor var. *striatus* FLEUTIAUX, Philip. Journ. Sci. § D 11 (1916) 228.

BOHOL. LUZON. MINDANAO. (Type localities.)

Genus ODONTOCARDUS Fleutiaux

151. ODONTOCARDUS RUFUS Fleutiaux.

Odontocardus rufus FLEUTIAUX, Proc. Haw. Ent. Soc. 8 (1934) 483.

BASILAN. MINDANAO, Lanao Province, Iligan: Misamis Province, Dapitan: Surigao Province: Bukidnon Province, Diklom, 2,000 feet (Phillips, March). NEGROS, Cuernos Mountains. (Type localities, all.)

152. ODONTOCARDUS ZWALUWENBURGI Fleutiaux.

Odontocardus zwaluwenburgi FLEUTIAUX, Bull. et Ann. Soc. ent. Belg. 74 (1934) 369.

MINDANAO, Surigao Province (type locality).

Genus CARDIOTARSUS Eschscholtz

153. CARDIOTARSUS FALLACIOSUS (Candèze).

Cardiophorus fallaciosus CANDÈZE, Elat. nouv., fasc. 6 (1896) 59.

PALAWAN, southern (type locality).

Genus NEODIPLOCONUS Hyslop

154. NEODIPLOCONUS ANGUSTUS Fleutiaux.

Neodiploconus angustus FLEUTIAUX, Proc. Haw. Ent. Soc. 8 (1934) 485.

LUZON, Mountain Province, Mount Data, 5,000 feet (Hadden, March) (type locality).

Described from a single specimen.

155. NEODIPLOCONUS BAKEWELLI (Fleutiaux).

Neodiploconus bakewelli FLEUTIAUX, Philip. Journ. Sci. § D 9 (1914) 447.

LUZON, Laguna Province, Los Baños; Mount Maquiling (type localities).

Numerous at 2,000 feet on Mount Maquiling in May and June (Hadden).

156. NEODIPLOCONUS CANTHARUS (Candèze).

Diploconus cantharus CANDÈZE, Elat. nouv., fasc. 5 (1892) 42.

BABUYANES (type locality). LUZON, Tayabas Province, Mount Banahao (Fleutiaux 5). MINDANAO (type locality), Misamis Province, Dapitan (Fleutiaux 5).

157. NEODIPLOCONUS CERVINUS (Candèze).

Diploconus cervinus CANDÈZE, Bull. Soc. ent. Belg. (1875) 125.

BABUYANES (type locality). LEYTE (type locality). LUZON, Benguet Subprovince, Irisan (Schultze 15). MINDANAO (type locality). * PANAY, Antique Province, Culasi (Cornell collection).

158. NEODIPLOCONUS CIPRINUS (Candèze).

Diploconus ciprinus CANDÈZE, Elat. nouv., fasc. 1 (1865) 47.

LUZON (type locality), Laguna Province, Mount Maquiling, 800 to 3,000 feet (Hadden, March to May; Fleutiaux det.). PANAY, Antique Province, Culasi (McGregor; Fleutiaux det., with a question).

Fairly abundant on Mount Maquiling.

159. NEODIPLOCONUS CONSANGUINEUS (Candèze).

Diploconus consanguineus CANDÈZE, Mon. des Elat. 1 (1860) 293.

All the islands (Candèze 2).

Described from Malaysia.

160. NEODIPLOCONUS COXALIS Fleutiaux.

Neodiploconus coxalis FLEUTIAUX, Philip. Journ. Sci. 49 (1932) 568.

LUZON, Laguna Province, Mount Maquiling, 400 feet (Hadden, June); Pangil (Hadden, May): Tayabas Province, Quezon Park (Hadden, May) (type localities).

161. NEODIPLOCONUS ERYTHRONOTUS (Candèze).

Diploconus erythronotus CANDÈZE, Elat. nouv., fasc. 1 (1865) 46.

LUZON (type locality), Laguna Province, Agricultural College (Hadden, May); Los Baños (Schultze 15); Mount Maquiling (Fleutiaux 4); Pangil (Hadden, May): Mountain Province, Baguio ("Bacio") (Cornell collection): Nueva Vizcaya Province, Imugan (Cornell collection): Tayabas Province, Mount Banahao (Cornell collection).

161a. NEODIPLOCONUS ERYTHRONOTUS (Candèze) var.

LUZON, Pangasinan Province, Asingan (Hadden, May; Fleutiaux det.).

In the single specimen seen, the elytra are red instead of blackish, being only slightly darker than the pronotum.

162. NEODIPLOCONUS FLEUTIAUXI Van Zwaluwenburg.

Diploconus nitidus FLEUTIAUX, Philip. Journ. Sci. § D 11 (1916) 231; nec *Diploconus nitidus* SCHWARZ, 1902.

Neodiploconus fleutiauxi VAN ZWALUWENBURG, Ann. & Mag. Nat. Hist. X 13 (1934) 596 (new name).

LUZON, Camarines Sur Province, Iriga (Hadden, June) : Tayabas Province, Mount Banahao (type locality).

163. NEODIPLOCONUS FUSCUS Fleutiaux.

Neodiploconus fuscus FLEUTIAUX, Philip. Journ. Sci. 49 (1932) 569.

LUZON, Laguna Province, Mount Maquiling, 400 feet (Hadden, June) (type locality) : Mountain Province, Mount Polis, Ifugao, 3,000 feet (Hadden, July; Fleutiaux det.).

164. NEODIPLOCONUS HADDENI Fleutiaux.

Neodiploconus haddeni FLEUTIAUX, Proc. Haw. Ent. Soc. 8 (1932) 48.

LUZON, Laguna Province, Mount Maquiling, 400 feet (Hadden, April) : Mountain Province, Baguio (Williams, June) (Baker) (type localities).

165. NEODIPLOCONUS MARGINATUS Fleutiaux.

Neodiploconus marginatus FLEUTIAUX, Proc. Haw. Ent. Soc. 8 (1932) 49.

LUZON, Mountain Province, Baguio (Williams, June) (Baker) (type locality) ; Mount Polis, Ifugao, 3,000 feet (Hadden, July) : Nueva Vizcaya Province, Imugan (Cornell collection).

166. NEODIPLOCONUS NIGRIPES Fleutiaux.

Neodiploconus nigripes FLEUTIAUX, Philip. Journ. Sci. 49 (1932) 568.

LUZON, Laguna Province, Mount Maquiling (type locality) (Hadden, May) : Mountain Province, Baguio, 5,000 feet (type locality) ; Camp 82, 6,000 feet (Hadden, March) ; Mount Data, 5,000 feet (Hadden, March) (type locality).

167. NEODIPLOCONUS NITENS Fleutiaux.

Neodiploconus nitens FLEUTIAUX, Proc. Haw. Ent. Soc. 8 (1934) 484.

LUZON, Mountain Province, Camp 82, 6,000 feet (Hadden, May) (type locality).

168. NEODIPLOCONUS PHILIPPINENSIS (Fleutiaux).

Diploconus philippinensis FLEUTIAUX, Philip. Journ. Sci. § D 9 (1914) 447.

LUZON, Laguna Province, Mount Maquiling (type locality). * MINDANAO, Bukidnon Province, Santa Fe, 2,000 feet (Phillips, June) : Lanao Province, Kolambugan (Fleutiaux collection) : Zamboanga Province, Kabasalan (Muzzall, March and April; Fleutiaux det.).

169. NEODIPLOCONUS POLITUS (Candèze).

Diploconus politus CANDÈZE, Bull. Soc. ent. Belg. (1875) 126.

ALABAT (type locality). LUZON, Laguna Province, Los Baños and Mount Maquiling (Fleutiaux 4).

Hadden took it on Mount Maquiling at from 400 to 3,000 feet from April to June on flowers of *Clethra lancifolia*.

170. NEODIPLOCONUS SURDUS Fleutiaux.

Neodiploconus surdus FLEUTIAUX, Proc. Haw. Ent. Soc. 8 (1934) 484.

MINDANAO, Bukidnon Province, Diklom, 2,000 feet (Phillips, March); Tangcolan (Baker) (type localities).

171. NEODIPLOCONUS UMBILICATUS (Candèze).

Diploconus umbilicatus CANDÈZE, Bull. Soc. ent. Belg. (1875) 125.
Diploconus angusticollis CANDÈZE.
Diploconus obscurus FLEUTIAUX.

All the islands (Candèze 2, p. cxxvi). LUZON, Laguna Province, Los Baños (Schultze 15); Mount Linian (Fleutiaux 5); Mount Maquiling, 400 feet (Hadden, April and May); Pangil (Hadden, May): Mountain Province, Baguio (Williams, June): Tayabas Province, Mount Banahao (Fleutiaux 5); Quezon Park, 1,000 feet (Hadden, June). PANAON (type locality). * PANAY, Antique Province, Culasi (Cornell collection).

Genus METRIAULACUS Schwarz

172. METRIAULACUS GOBIUS (Candèze).

Melanotus gobius CANDÈZE, Mon. des Elat. 3 (1860) 329.

Recorded by Fleutiaux (9, part 5, p. 214) from the Philippines, without specific locality. Originally described from Java; it occurs also in Indo-China and northern India.

Genus MELANOTUS Eschscholtz

173. MELANOTUS (SPHENISCOSOMUS) ALBIVELLUS Candèze.

Melanotus (*Spheniscosomus*) *albivellus* CANDÈZE, Elat. nouv., fasc. 1 (1865) 48.

* LUZON, Laguna Province, Mount Maquiling (Hadden, April; Fleutiaux det.).

Known also from Borneo, Java, Sumatra, Indo-China, and Penang.

174. MELANOTUS EBENINUS Candèze.

Melanotus ebeninus CANDÈZE, Mon. des Elat. 3 (1860) 335.

BATAN, Batanes (Schultze 15). JOLO (Fleutiaux 4). LUZON, Rizal Province, Pasay (McGregor, July, at light): Camarines Sur Province, Iriga (Hadden, June): Isabela Province, San Luis

(Schultze 15) : Laguna Province, Agricultural College (Pemberton, March to June) ; Los Baños (Fleutiaux 4) ; Mount Maquiling, bred from dead wood of "taluto" (*Pterocymbium tinctorium*) and on flowers of *Sapindus saponaria* (Hadden, November) ; Pangil (Hadden, May) : Nueva Vizcaya Province, Imugan (Cornell collection) : Tarlac Province (Schultze 15) : Tayabas Province, Quezon Park (Hadden, June). MINDANAO, Bukidnon Province, Diklom, 3,000 feet (Phillips, March) : Lanao Province, Iligan (Fleutiaux 5) : Misamis Province, Cagayan (Fleutiaux 5) : Zamboanga Province, Kabasalan (Muzzall, April and May). * PANAY, Antique Province, Culasi (Cornell collection).

175. MELANOTUS INTERJECTUS Candèze.

Melanotus interjectus CANDÈZE, Elat. nouv., fasc. 6 (1896) 65.

BALABAC (type locality).

176. MELANOTUS PHLOGOSUS Candèze.

Melanotus phlogosus CANDÈZE, Mon. des Elat. 3 (1860) 325.

LUZON (Schultze 15).

Originally described from the Philippines and southern China.

177. MELANOTUS PISCICULUS Candèze.

Melanotus pisciculus CANDÈZE, Mon. des Elat. 3 (1860) 330.

LUZON, Manila (type locality).

178. MELANOTUS SCRIBANUS Candèze.

Melanotus scribanus CANDÈZE, Elat. nuov., fasc. 5 (1893) 48.

LUZON, Laguna Province, Mount Maquiling (Schultze 15). MINDORO (type locality).

178a. MELANOTUS SCRIBANUS var. BAKERI Fleutiaux.

Melanotus scribanus var. *bakeri* FLEUTIAUX, Philip. Journ. Sci. § D 11 (1916) 231.

LUZON, Laguna Province, Los Baños, Mount Maquiling (type localities) : Manila (Cornell collection). * MINDANAO, Zamboanga Province, Kabasalan (Muzzall, March and April; Fleutiaux det.).

Hadden collected it on flowers of "santan puti" at 3,000 feet on Mount Maquiling in July.

Genus PRISTILOPHUS Germar

179. PRISTILOPHUS LUZONICUS (Candèze).

Corymbites luzonicus CANDÈZE, Elat. nouv., fasc. 1 (1865) 53.

All the islands (Candèze 2). LUZON (type locality), Laguna Province, Mount Maquiling (Fleutiaux 4) : Tayabas Province, Mount Banahao (Cornell collection).

Fairly common at 400 feet on Mount Maquiling, April to June (Hadden).

Genus LUZONICUS Fleutiaux

180. LUZONICUS BAKERI Fleutiaux.

Luzonicus bakeri FLEUTIAUX, Philip. Journ. Sci. § D 11 (1916) 232.

LUZON, Laguna Province, Mount Maquiling (type locality).

Genus NEOTRICHOPHORUS Jacobson

181. NEOTRICHOPHORUS GERMANUS (Candèze) var.

Ludius germanus CANDÈZE, Ann. Mus. Genova (1894) 498.

Fleutiaux (5) records variety *a* from Mindanao, Agusan Province, Iligan. The typical form and the variety are known from Sumatra.

182. NEOTRICHOPHORUS HIRSUTUS (Candèze).

Ludius hirsutus CANDÈZE, Bull. Soc. ent. Belg. (1875) 126.

LUZON, Laguna Province, Mount Maquiling (Fleutiaux 4): Tayabas Province, Mount Banahao (Cornell collection). PALAWAN, Puerto Princesa (Fleutiaux 5).

183. NEOTRICHOPHORUS PHILLIPSI sp. nov.

Female, 10 millimeters. Head and thorax prominent, rest of body strongly narrowed; elytra little more than twice length of head and prothorax. Jet black above and beneath, antennæ entirely black; rather shiny, especially pronotum; trochanters and femora luteous, tibiæ piceous to black, tarsi dark rufous. Clothed with semierect, rather dense hairs, varying with the location: On head very fine, fulvous; on pronotum cinereous, becoming coarser toward sides and base; on elytra very fine, fulvous to obscure on disc, and (best seen from the rear) a band of fulvous, coarser hairs along suture, widening distally, with another similar band along the side margin; beneath, hairs short, fairly fine, fulvous.

Head very precipitous, flattened in front, margin acutely rounded; rather finely and evenly punctate. Antennæ with fulvous to black hairs; exceeding the posterior angles of pronotum by about two and one-half joints; 2d and 3d subcylindrical, subequal, together about two-thirds length of 4th; 4th to 10th serrate; 11th elongate, attenuate on distal half.

Pronotum about half as long again as wide, strongly convex; punctation as on head, uniform; sides subparallel, narrowed on anterior fifth; posterior angles faintly divergent, incurved at tips, strongly unicarinate, the carina diverging sharply from

the lateral margin; a group of two or three black bristles projecting laterally from the tips at about a 90° angle. Basal declivity abrupt; a median impressed line on basal half. Mucro horizontal, slightly up-curved behind coxæ. Mesosternal cavity more or less horizontal; metasternum strongly convex anteriorly.

Scutellum precipitous, elongate-triangular, finely punctate.

Elytra, at humeri only, about as wide as prothorax; attenuate to about posterior third, and thence more sharply to the conjointly rounded apex; sutural margins faintly divergent apically. Striæ consisting of rather coarse punctations which become much finer posteriorly; intervals nearly flat, finely punctate (subrugosely toward base). Body beneath finely and uniformly punctate.

Described from a holotype female. Differs from similar described species by the distinctive hair pattern on the elytra, which is difficult to see from the anterior end. Otherwise it seems closest to *antennatus* Candèze and *illotipes* Candèze; in the former species the last three antennal joints are said to be flavous, whereas in *phillipsi* all the joints are black; Candèze describes the elytral tips of *illotipes* as emarginate, while in the present species they are definitely entire.

The type is in the collection of the Experiment Station, Hawaiian Sugar Planters' Association, Honolulu, T. H. The species is dedicated to Mr. L. H. Phillips, of Bugo, Misamis, Mindanao, whose collecting has added considerably to our knowledge of the elaterid fauna of Mindanao.

MINDANAO, Bukidnon Province, Diklom, 3,000 feet (Phillips, April).

Genus APHANOBIUS Eschscholtz

184. APHANOBIUS LONGICOLLIS Eschscholtz.

Aphanobius longicollis ESCHSCHOLTZ, Thon. Arch. 2 (1829) 33.
Aphanobius longus CANDÈZE.

"Manilla" (type locality). MINDANAO, Bukidnon Province, Diklom, 2,000 feet (Phillips, March; Fleutiaux det.).

Known also from Borneo and Java.

APHANOBIUS LONGITHORAX (Wiedemann).

Elater longithorax WIEDEMANN, Zool. Mag. 2 (1823) 106.

Philippine references to this species (including Schultze's record of Balabac) are doubtful. Schenkling's Catalogue incorrectly synonymizes *A. longus* Candèze under this, instead of the preceding, species. *Aphanobius longithorax* is known from Bengal.

Genus PARALLELOSTETHUS Schwarz

185. PARALLELOSTETHUS CONCIPENNIS (Schwarz).

Steatoderus concipennis SCHWARZ, Stett. Ent. Zeit. (1902) 296.

Philippines (type locality).

Genus LUDIGENUS Candèze

186. LUDIGENUS POLITUS Candèze.

Ludigenus politus CANDÈZE, Mon. des Elat. 4 (1863) 326.

Widespread, especially in the south (Candèze 2). LUZON, Camarines Sur Province, Iriga (Hadden, June); Mabatobato, Pili (Hadden, May): Laguna Province, Agricultural College (Hadden); Mount Maquiling, 400 to 800 feet (Hadden, May, June, August, October); Pangil (Hadden). MINDANAO (Candèze 2); Zamboanga Province, Tambanan (Muzzall; Fleutiaux det.). NEGROS, Mount Canlaon (Schultze 15). PALAWAN, Bacuit (Schultze 15). SIBUYAN (Schultze 15).

Originally described from the Philippines, Borneo, and Siam; this species is known also from Celebes, Indo-China, and the Andamans.

Genus AGONISCHIUS Candèze

187. AGONISCHIUS BAKERI Fleutiaux.

Agonischius bakeri FLEUTIAUX, Philip. Journ. Sci. § D 11 (1916) 232.

LUZON, Tayabas Province, Mount Banahao (type locality).

188. AGONISCHIUS BALABAKENSIS Candèze.

Agonischius balabakensis CANDÈZE, Elat. nouv., fasc. 6 (1895) 77.

BALABAC (type locality).

189. AGONISCHIUS BASALIS Candèze.

Agonischius basalis CANDÈZE, Bull. Soc. ent. Belg. (1875) 127.

LUZON (type locality), Ambos Camarines Province, Mount Isarog (Cornell collection): Laguna Province, Mount Maquiling, up to 800 feet, on flowers of *Terminalia nitens*, of *Ehretia philippinensis*, and of *Clethra lancifolia* (Hadden, April to June): Nueva Vizcaya Province, Imugan (Cornell collection): Tayabas Province, Mount Banahao (Cornell collection).

189a. AGONISCHIUS BASALIS Candèze var.

* MINDANAO, Bukidnon Province, Diklom, 3,000 feet (Phillips, March; Fleutiaux det.): Lanao Province, Kolambugan (Cornell collection): Zamboanga Province, Kabasalan, on flowers (Muzzall, August).

Differs from the typical form in having a rufous stripe on the outer margin of the elytra for about two-thirds their length.

190. AGONISCHIUS BREVICOLLIS Candèze.

Agonischius brevicollis CANDÈZE, Bull. Soc. ent. Belg. (1875) 127.

LUZON (type locality).

191. AGONISCHIUS FUSIFORMIS Candèze.

Agonischius fusiformis CANDÈZE, Bull. Soc. ent. Belg. (1875) 127.

* LUZON, Ambos Camarines Province, Mount Isarog (Cornell collection): Laguna Province, Mount Maquiling, under bark (Hadden, February to June; Fleutiaux det.): Nueva Vizcaya Province, Imugan (Cornell collection): Tayabas Province, Quezon Park (Hadden, May). MINDANAO (type locality), Lanao Province, Momungan (Cornell collection): Zamboanga Province, Kabasalan, on flowers (Muzzall, March and August).

192. AGONISCHIUS MARGINATUS Candèze.

Agonischius marginatus CANDÈZE, Bull. Soc. ent. Belg. (1875) 127.

MINDANAO (type locality).

193. AGONISCHIUS MUZZALLI Fleutiaux.

Agonischius muzzalli FLEUTIAUX, Proc. Haw. Ent. Soc. 8 (1934) 485.

MINDANAO, Misamis Province, Dapitan (Baker): Zamboanga Province, Kabasalan (Muzzall, March) (type localities).

194. AGONISCHIUS NIGERRIMUS Fleutiaux.

Agonischius nigerrimus FLEUTIAUX, Bull. et. Ann. Soc. ent. Belg. 74 (1934) 369.

LUZON, Nueva Vizcaya Province, Imugan (Cornell collection) (type locality).

195. AGONISCHIUS PRAEUSTUS Fleutiaux.

Agonischius praeustus FLEUTIAUX, Proc. Haw. Ent. Soc. 8 (1934) 485.

LUZON, Laguna Province, Mount Maquiling (Hadden, June) (type locality).

Described from a single specimen.

Genus GLYPHONYX Candèze

196. GLYPHONYX ATTONITUS Candèze.

Glyphonyx attonitus CANDÈZE, Elat. nouv., fasc. 6 (1896) 78.

LUZON, Laguna Province, Los Baños (Schultze 15). PALAWAN (type locality).

Although this was considered by Candèze to be a variety of his *G. erraticus*, Fleutiaux (4) believes it to be a valid species.

197. GLYPHONYX DISSIMILIS Candèze.

Glyphonyx dissimilis CANDÈZE, Elat. nouv., fasc. 6 (1896) 78.

BALABAC (Schultze 15).

Type locality Borneo.

198. GLYPHONYX ERRATICUS Candèze.

Glyphonyx erraticus CANDÈZE, Bull. Soc. ent. Belg. (1875) 127.

LUZON (type locality); Laguna Province, Mount Maquiling, 2,000 feet (Hadden, June; Fleutiaux det.): Tayabas Province, Mount Banahao (Fleutiaux 5). MINDANAO (type locality); Agusan Province, Butuan (Fleutiaux 5): Zamboanga Province, Kabasalan (Muzzall, March and April).

199. GLYPHONYX FALSUS Candèze.

Glyphonyx falsus CANDÈZE, Elat. nouv., fasc. 6 (1896) 78.

BALABAC (Schultze 15). MINDANAO, Agusan Province, Butuan (Fleutiaux 5). PALAWAN, southern (type locality).

Known also from Java.

200. GLYPHONYX FENEUS Candèze.

Glyphonyx feneus CANDÈZE, Elat. nouv., fasc. 6 (1896) 78.

BALABAC (type locality). LUZON, Laguna Province, Los Baños (Fleutiaux 5); Mount Maquiling 2,000 feet (Hadden, June): Tayabas Province, Mount Banahao (Fleutiaux 5).

GLYPHONYX ORNATUS Fleutiaux.

Glyphonyx ornatus FLEUTIAUX, Philip. Journ. Sci. § D 11 (1916) 283.

See *Megapenthes lewisi* Fleutiaux.

201. GLYPHONYX POSTICUS Candèze.

Glyphonyx posticus CANDÈZE, Bull. Soc. ent. Belg. (1875) 127.

LUZON, Laguna Province, Mount Maquiling (Fleutiaux 5). MINDANAO (type locality), Agusan Province, Butuan (Fleutiaux 5): Zamboanga Province, Kabasalan, on flowers (Muzzall, April, May, August).

Genus SILESIS Candèze

202. SILESIS CASTANEUS Fleutiaux.

Silesis castaneus FLEUTIAUX, Proc. Haw. Ent. Soc. 8 (1934) 486.

* LUZON, Laguna Province, Mount Maquiling, 2,000 feet, on *Vitex parviflora* (Hadden, June; Fleutiaux det.). MINDANAO (type locality), Bukidnon Province, Diklom, 3,000 feet (Phillips, March): Zamboanga Province, Kabasalan (Muzzall, March).

Genus HEMIOPS Laporte de Castelnau

203. HEMIOPS FLAVA Castelnau.

Hemiops flava CASTELNAU, Silbermann's Rev. Ent. 4 (1836) 15.

Recorded by Fleutiaux (7, p. 175) from the Philippines without more exact data. The species is known also from China, Malaysia, and Java.

204. HEMIOPS SEMPERI Candèze.

Hemiops semperi CANDÈZE, Elat. nouv., fasc. 2 (1878) 53.

LUZON (type locality), Laguna Province, Los Baños (Williams, June, October, November); Mount Maquiling, 400 feet (Hadden, April to October): Rizal Province, Montalban Gorge (Schultze 15): Tayabas Province, Mount Banahao (Cornell collection). NEGROS, Occidental Negros Province, Mount Canlaon (Schultze 15). * PANAY, Antique Province, Culasi (Cornell collection).

Genus THAROPSIDES Fleutiaux

THAROPSIDES BAKERI Fleutiaux.

Tharopsides bakeri FLEUTIAUX, Bull. Mus. Paris (1918) 236, footnote.

See *Eumoeus bakeri* (Fleutiaux).

BIBLIOGRAPHY

CANDÈZE, ERNEST.

1. Monographie des Élatérides 1–4 (1857–1863).
2. Relevé des Élatérides des îles Philippines. Bull. Soc. ent. Belg. (1875) 118–127.
3. Élatérides nouveaux, fasc. 1–6 (1865–1900).

FLEUTIAUX, EDMOND.

4. Elateridæ des îles Philippines. Philip. Journ. Sci. § D 9 (1914) 441–449.
5. Elateridæ des îles Philippines, II. Philip. Journ. Sci. § D 11 (1916) 219–233.
6. Deux espèces nouvelles de Coleopteres (Elateridæ). Philip. Journ. Sci. 18 (1921) 73–74.
7. Faune Ent. de l'Indochine Française, fasc. 7 (June, 1924) 184 pp. (Opuscules de l'Institut Scientifique de l'Indochine, No. 2, Saigon.)
8. Validité du genre Quasimus Gozis, 1886. Bull. Soc. ent. France (1928) 148–149, 1 fig.
9. Les Élatérides de l'Indochine Française:
   Part 1: Faune des Colonies françaises 1 (1927) 53–122, 2 pls.
   Part 2: Encycl. Ent., Coleop. III (1928) 103–177.
   Part 3: Bull. Mus. Paris II 2 (1930) 636–644.
   Part 4: Bull. Soc. zool. France 56 (1931) 306–334.
   Part 5: Ann. Soc. ent. France 102 (1933) 205–235. (Other parts to follow.)

FLEUTIAUX—Continued.

10. Encycl. Ent., Coleop. III, fasc. 4 (December, 1928) 2.
11. Descriptions d'Élatérides nouveaux des îles Philippines. Proc. Hawaiian Ent. Soc. 8 (1932) 47–49.
12. Melasidæ et Elateridæ nouveaux des îles Philippines. Philip. Journ. Sci. 49 (1932) 565–569.
13. Élatérides nouveaux des îles Philippines. Proc. Haw. Ent. Soc. 8 (1934) 477–486.
14. Eucnemidæ et Elateridæ nouveaux. Bull. et Ann. Soc. ent. Belg. 74 (1934) 363–370.

SCHULTZE, WILLIE.

15. A Catalogue of Philippine Coleoptera. Philip. Journ. Sci. § D 11 (1916) 59–66. Elateridæ.

STUDIES ON PHILIPPINE MORDELLIDÆ (COLEOPTERA), II[1]

By Eugene Ray

Of Urbana, Illinois

The following descriptions are the result of a further study of the Philippine Mordellidæ contained in the collection of Dr. F. J. Psota, of Chicago, Illinois. Two of the species were collected by C. F. Clagg on Mindanao in 1930, the others by the late C. F. Baker in 1915. All specimens, including types, remain in the collection of Dr. F. J. Psota.

A list of the known Philippine Mordellidæ is appended in order to facilitate recognition of members of this obscure family of Coleoptera.

DELLAMORA PUBESCENS sp. nov.

Moderately elongate, densely covered with fine, flavous, recumbent pubescence. Derm of head and prothorax castaneous, that of elytra fuscous. Maxillary palpi castaneous, apical segment large, triangular; mandibles fuscous; antennæ flavous, long, reaching second abdominal segment, segments 2 and 3 short, equal, together as long as 4, 4 to 11 subequal, 11 rounded, slightly enlarged at apical third. Ventral surface fuscous, covered with recumbent, flavous pubescence, less dense than on dorsal surface; anterior legs, intermediate femora, and terminal segment of posterior tarsi castaneous, remainder fuscous; penultimate segment of anterior and intermediate tarsi bilobed; posterior tibiæ with three oblique, parallel, equal ridges, each extending one-third across external surface; basitarsi with four short ridges, second and third segments each with two ridges. Anal style long, stout, truncate at apex, as long as the two apical ventral segments together. Length to end of elytra, 5.5 mm; to apex of anal style, 6.7.

One specimen, holotype, male, La Lun Mountains, Mindanao, July 3, 1930 (*C. F. Clagg*).

[1] Studies on Philippine Mordellidæ, I, Coleopterological Contributions 1 (1930) 143–158, pls. 25 and 26.

This species may be separated from the other Philippine members of the genus by the difference in the number of the ridges on the posterior tibiæ and tarsi, and the peculiar color and antennal segmentation.

MORDELLISTENA CLAGGI sp. nov.

Moderately elongate, slender; surface covered with dense, long pubescence, partaking of ground color; head castaneous, pronotum lighter, with a pair of subapical marginal spots and a central postmedian one; elytra piceous. Head convex; antennæ castaneous, long, reaching basal abdominal segment. Segments 1 and 2 and 3 and 4 equal to each other, 5 to 10 broadened, 11 twice as long as 10; maxillary palpi large, flavous, apical segment enlarged, broadly triangular, outer edge curved; eyes large, piceous, margin irregularly flavous. Pronotum convex, sides parallel, basal angles slightly obtuse, midbasal lobe pronounced, covering part of scutellum. Elytra elongate, sides parallel to within one-fifth of apex. Ventral surface piceous, last dorsal and ventral abdominal segments castaneous, former two and one-half times length of latter and attenuate to apex. Anterior femora, posterior tarsi, and a small area at base of hind femora flavous; anterior tibiæ and tarsi and intermediate legs fuscous, posterior femora and tibiæ piceous. Hind tibiæ with two ridges, anterior one extending entirely across outer face; first and second segments of posterior tarsi each with two ridges. Length to end of elytra, 1.9 mm; to apex of anal style, 2.2.

One specimen, holotype, male, Lawa, Davao Province, Mindanao, May 5, 1930 (*C. F. Clagg*). The species is dedicated to the collector.

This species is distinct from any of the Indo-Australasian members of the genus, its closest relative being *gracilicauda* Blair,[2] from which it differs in its dissimilar antennæ, more parallel form, attenuate anal style, darker color, and the longer anterior ridge of the posterior tibiæ.

DICLIDIA OCEANICA sp. nov.

Oblong-oval; upper surface transversely strigate and clothed with fine, grayish pubescence, placed longitudinally. Head piceous, front flavous, outer edge of mandibles black; maxillary palpi flavous, terminal segment enlarged, rounded-triangular; antennal segments 1 to 7 flavous, 8 darker (9 to 11 missing);

[2] *Mordellistena gracilicauda* Blair, Ann. & Mag. Nat. Hist. IX 9 (1922) 568. (Fiji.)

basal segment two-thirds as long as 2; 3 and 4 together equal to 2; 5 and 6 equal; 7 and 8 each equal in length to 3, but broader. Prothorax piceous; sides rounded. Elytra piceous, elongate, rounded at apex. Ventral surface piceous, grayish pubescent. Legs piceo-castaneous, tarsi paler; spurs of hind tibiæ subequal. Length, 2 mm.

One specimen, holotype, female, "Philippine Is.," May 20, 1916 (*C. F. Baker*).

This species and the one following are the first two members of the genus to be described from this part of the globe, the only previously known forms having been recorded from North America.

These species differ from the Nearctic forms chiefly in the different relative lengths of the various antennal segments.

DICLIDIA ANTIPODES sp. nov.

Oblong-oval, moderately elongate; upper surface transversely strigate; reddish brown, covered with fine grayish pubescence. Head and maxillary palpi reddish brown; antennæ piceous, segments 1 and 2 castaneous, 3 to 11 grayish to pubescent, 7 to 11 transverse, forming an elongate club; segments 1 to 3 equal, 4 and 5 shorter, equal to each other, 6 equal to 2. Ventral surface, including legs, castaneous; abdominal segments somewhat darker. Length, 2 to 2.3 mm.

Five specimens, holotype, male, allotype, female, and paratype, male, Tankulan, Mindanao, June 14, 1915; two paratypes, female, Bayombong, Luzon, May 10, 1916; all collected by C. F. Baker.

LIST OF PHILIPPINE MORDELLIDÆ

MORDELLINÆ

Genus GLIPA Leconte

Glipa LECONTE, Colleop. of Kans. & E. New Mex. (1857) 17.

1. *aurata* RAY, Coleop. Contrib., I, No. 3 (1930) 145, pl. 26, fig. 3.
2. *baeri* PIC, Mel. exot.-ent., fasc. 25 (1917) 22; RAY, Coleop. Contr., I, No. 3 (1930) 146, pl. 26, fig. 1.
3. *bakeri* RAY, Coleop. Contr., I, No. 3 (1930) 146, pl. 26, fig. 4.
4. *balabacana* PIC, Mel. exot.-ent., fasc. 26 (1917) 12.
5. *isolata* RAY, Coleop. Contr., I, No. 3 (1930) 145, pl. 26, fig. 5.
6. *malaccana* PIC, Echange 27 (1911) 190; RAY, Coleop. Contr., I, No. 3 (1930) 14, pl. 25, figs. 3, 4; pl. 26, fig. 6.
7. *palawana* PIC, Mel. exot.-ent., fasc. 40 (1923) 29.

Genus TOMOXIA Costa

Tomoxia COSTA, Fauna Regni Napoli, Mordell. (1854) 8.

1. *antipodes* RAY, Coleop. Contr., I, No. 3 (1930) 149.
2. *diversimaculata* RAY, Coleop. Contr., I, No. 3 (1930) 147.
3. *intermedia* RAY, Coleop. Contr., I, No. 3 (1930) 149.
4. *philippinensis* RAY, Coleop. Contr., I, No. 3 (1930) 148.

Genus MORDELLA Linnæus

Mordella LINNÆUS, Syst. Nat. ed. 10 (1758) 420.

1. *bistrinotata* PIC, Mel. exot.-ent., fasc. 52 (1928) 12; RAY, Coleop. Contr., I, No. 3 (1930) 150.
2. *composita* WALKER,[8] Ann. & Mag. Nat. Hist. III 2 (1858) 286; RAY, Coleop. Contr., I, No. 3 (1930) 151.

Genus DELLAMORA Normand

Dellamora NORMAND, Bull. Soc. ent. France (1917) 284.

1. *antipodes* RAY, Coleop. Contr., I, No. 3 (1930) 153.
2. *bakeri* RAY, Coleop. Contr., I, No. 3 (1930) 152, pl. 25, fig. 5.
3. *iridescens* RAY, Coleop. Contr., I, No. 3 (1930) 154.
4. *maculata* RAY, Coleop. Contr., I, No. 3 (1930) 153.
5. *ochracea* RAY, Coleop. Contr., I, No. 3 (1930) 153.
6. *philippinensis* RAY, Coleop. Contr., I, No. 3 (1930) 151, pl. 25, fig. 6.
7. *pubescens* sp. nov.

Genus MORDELLISTENA Costa

Mordellistena COSTA, Fauna Regni Napoli, Mord. (1854) 16, 31.

1. *claggi* sp. nov.
2. *longicauda* RAY, Coleop. Contr., I, No. 3 (1930) 155.

ANASPINÆ

Genus DICLIDIA Leconte

Diclidia LECONTE, Proc. Acad. Nat. Sci. Phila. 14 (1862) 43.

1. *antipodes* sp. nov.
2. *oceanica* sp. nov.

[8] This determination has been questioned in private correspondence by K. G. Blair, of the British Museum.

PHILIPPINE RUSTS IN THE CLEMENS COLLECTION 1923–1926, I [1]

By J. C. Arthur and George B. Cummins

Of the Department of Botany, Purdue University Agricultural Experiment Station, Lafayette, Indiana

THREE PLATES

It is not common for a collector of phanerogamic plants and fern allies to include also the much less conspicuous microfungi. There is consequently more than usual credit to be given to Mrs. Mary S. Clemens for her extensive and discriminating work in gathering the rich tropical vegetation and preserving it in suitable form for study by specialists, and especially for the attention that she has given to the parasitic fungi. Mrs. Clemens began sending the senior author a few collections of rusts from the Philippines in 1923. Her interest in this group of fungi increased, and has continued to the present time, until few regions of the tropical world have been so thoroughly explored. Marvelous endurance and an intrepid nature have overcome almost unbelievable obstacles in penetrating jungles and ascending the highest mountains. Aided by her husband, and imbued with the devoted spirit of Protestant missionaries, she has covered a large part of the Philippine area.

It was the original intention that the senior author should study the collections as they were received, but after one futile effort the material came in such abundance, and other duties pressed so heavily, that only desultory efforts were made until Doctor Cummins joined in the work. As joint author he has shown much zeal in assorting and determining the collections. They embrace what Mrs. Clemens had sent between the years 1923 and 1926. It now appears possible after ten years of delay to report on all material that has been received. The hosts have been verified or determined by Dr. E. D. Merrill.

The first installment presented herewith embraces rusts occurring on monocotyledonous hosts and one species on Pinaceæ.

[1] Contribution from the Department of Botany, Purdue University Agricultural Experiment Station, Lafayette, Indiana.

There are fifty-one species, represented by ninety-six collections. It is with more than usual pleasure that we are able to name a new species in honor of Mrs. Clemens, especially as it belongs to a rare and recently established genus not before reported outside of tropical America. All types are deposited in the Arthur Herbarium, Purdue University.

ON PINACEÆ

1. PERIDERMIUM INSULARE Syd.

On *Pinus insularis* Endl., LUZON, Benguet Subprovince, Mount Santo Tomas, February 19, 1935, *Clemens s. n.;* February 24 to 27, 1925, *Clemens 4967.*

ON GRAMINEÆ

2. ANGIOPSORA CLEMENSAE sp. nov. Plate 1, fig. 1.

Uredia hypophylla, minuta, ca. 50–100 μ diam., flavida, in centro poro aperta, corona densissima paraphysium introrsar curvatar cincta; urediosporae obovoideae vel ellipsoideae, 16–19 x 21–26 μ; membrana 1 μ cr., pallide brunnea, dense et breviter echinulata, poris germ. obscuris, 4, equatorialibus. Telia hypophylla, atra, aggregata in macula 1–5 mm lata, 3–10 mm longa; teliosporae oblongae, 10–15 x 16–29 μ; membrana 1.5 μ cr., ad apicem leviter incrassata, 2–3 μ, cinnamomea, epedicellata, levis.

On *Panicum Warburgii* Mez., LUZON, Pangasinan Province, Anda, March 24, 1925, *Clemens 6946.*

This species, a typical *Angiopsora* in both uredia and telia, adds a genus of hosts, and also extends the range of the genus beyond that reported by Mains [2] when he separated the genus from *Puccinia.* The species is named in honor of the collector, Mrs. Mary Strong Clemens, whose collections have greatly advanced our knowledge of the Uredinales of the Philippine Islands.

3. PUCCINIA ORIENTALIS (Syd. and Butl.) comb. nov.

Diorchidium orientale Syd. and Butl.

On *Panicum Warburgii* Mez., LUZON, Manila, October 2, 1923, *Clemens 1601;* February 14, 1924, *Clemens 1601a, 1601b:* Pangasinan Province, Anda, March 23, 1935, *Clemens s. n.* On *Panicum* sp., LUZON, Bulacan Province, Sibul Springs, December, 1924, *Clemens 4943.*

[2] Mycologia 26 (1934) 122–132.

The hosts of *1601, 1601a,* and *1601b* were originally identified in part as *Isachne miliacea.* Most of the material was seen by both Doctor Merrill and Doctor Hitchcock, who finally decided that the host probably is *Panicum Warburgii* for all three numbers. The rust has not been reported on grasses other than *Panicum.*

4. PUCCINIA SUBCENTRIPORA sp. nov. Plate 2, fig. 3.

Uredia hypophylla, brunnea; urediosporae ellipsoideae vel globosae, 24–30 x 29–39 μ; membrana 3–4 μ cr., fuscobrunnea, echinulata, poris germ. 4, equatorialibus. Telia non visa; teliosporae oblongae vel ellipsoideae, 19–26 x 29–39 μ; membrana ubique 1.5–2 μ cr., castaneo-brunnea, levi, poris in media cellula inferna; pedicelo hyalino, brevi, fragili.

On *Panicum punctatum* Burm., LUZON, Pangasinan Province, Rosales, February 1 to 14, 1925, *Clemens 5897:* Nueva Ecija Province, Gapan, February 1 to 14, 1925, *Clemens 5898* (type).

Species of *Puccinia* which have teliospores with a uniform wall and the lower germ pore below the septum are uncommon on grasses. For that reason this species is interesting and distinct. The urediospores often appear to be verrucose, due to the thickness of the wall and the closeness of the sculpturing, but are echinulate.

This species appears to be closely related to *Puccinia brachycarpa* Syd. but differs in having larger urediospores and teliospores with smooth walls.

5. PUCCINIA LEVIS (Sacc. and Bizz.) Magn.

On *Digitaria corymbosa* (Roxb.) Merr., MINDANAO, Davao Province, Todaya, Mount Apo, June 17 and 18, 1924, *Clemens 2064, 2064a.*

6. PUCCINIA PASPALICOLA (P. Henn.) Arth.

On *Digitaria sanguinalis* (L.) Scop. var. *australis* Thwait., LUZON, Manila, December 7, 1923, *Clemens 1712:* Pangasinan Province, Rosales and vicinity, February 1 to 14, 1925, *Clemens 5899, 5899a.*

7. PUCCINIA BRACHYCARPA Syd.

On *Chamaeraphis squarrosa* (L. f.) Merr., LUZON, Manila, October 2, 1923, *Clemens 1599.*

In his description of this species Sydow [3] did not mention the location of the germ pores in the teliospores. The pore is apical

[3] Ann. Myc. 29 (1931) 148.

in the upper cell but is near the pedicel in the lower cell. Because of the finely sculptured wall and the location of the lower pore this species is especially interesting and distinctive. Few species of *Puccinia* on grasses have such teliospores.

A few urediospores are present in the telia in this collection and a description follows. Urediospores globoid, 18 to 26 by 23 to 27 μ; wall dark chestnut-brown, 2.5 to 3.5 μ thick, closely and finely verrucose-echinulate, the pores 4, equatorial, distinct.

8. PUCCINIA CITRATA Syd.

On *Andropogon micranthus*, LUZON, Benguet Subprovince, Mount Pulog, February 25, 1925, *Clemens 5015*. On *Andropogon* sp., LUZON, Benguet Subprovince, Mount Pulog, February 24 to 27, 1925, *Clemens 4979a, 5015a*. On *Ischaemum* sp. ? LUZON, Benguet Subprovince, Baguio, February, 1925, *Clemens 5787*. On *Ischaemum aristatum* L., LUZON, Bulacan Province, Santa Maria, November, 1924, *Clemens 4859*.

9. PUCCINIA PURPUREA Cooke.

On *Andropogon* sp., LUZON, Benguet Subprovince, Adouay, February 24, 1925, *Clemens 4977;* Mount Pulog and vicinity, February 24 to 27, 1925, *Clemens 4978b:* Nueva Vizcaya Province, Santa Fe, January 25, 1924, *Clemens 1694*.

10. PUCCINIA RUFIPES Diet. Plate 2, fig. 1.

On *Imperata cylindrica* (L.) Beauv., LUZON, Tarlac Province, Tarlac, December, 1924, *Clemens 4875;* Paniqui, January, 1925, *Clemens s. n.:* Pangasinan Province, Rosales and vicinity, February 1 to 14, 1925, *Clemens 5895, 5896*. MINDANAO, Davao Province, Daron, May, 1924, *Clemens 4926*.

11. PUCCINIA BENGUETENSIS Syd.

On *Pollinia argentea* Trin., LUZON, Pangasinan Province, Rosales and vicinity, February 1 to 14, 1925, *Clemens 5893*.

12. PUCCINIA POLLINIAE-QUADRINERVIS Diet. Plate 2, fig. 2.

On *Pollinia quadrinervis* Hack., LUZON, Benguet Subprovince, Mount Pulog and vicinity, February 24 to 27, 1925, *Clemens 5013;* Baguio Highway, February, 1925, *Clemens 5794*.

The host for *5794* was labeled as possibly being a species of *Andropogon* or *Ischaemum*, but the urediospores (no telia are present) agree so well with this species that the host is listed as above. The rust is similar to *Uredo ischaemi-ciliati* Petch but differs in having closer and more nearly cubical sculpturing on the walls of the urediospores.

13. PUCCINIA ERYTHROPUS Diet.

On *Miscanthus sinensis* Anders., LUZON, Benguet Subprovince, Baguio, February 27 and 28, 1925, *Clemens 5115*. On *Miscanthus* sp. ? LUZON, Benguet Subprovince, Baguio, February, 1925, *Clemens 5109*.

14. PUCCINIA INVENUSTA Syd.

On *Phragmites vulgaris* (Lam.) Trin. (*P. communis* Trin.), LUZON, Pangasinan Province, Rosales and vicinity, February 1 to 14, 1925, *Clemens s. n.*

Only urediospores are present in this collection. The wall is verrucose-echinulate rather than minutely verrucose, but the specimen agrees closely in other respects.

15. PUCCINIA CYNODONTIS Lacroix.

On *Cynodon dactylon* Pers., LUZON, Zambales Province, Castillejos, March, 1924, *Clemens 1725*.

16. UROMYCES LEPTODERMUS Syd.

On *Panicum cocospermum* Steud., LUZON, Nueva Vizcaya Province, Dalbergia Springs, April, 1926, *Clemens 18000* (!). On *Panicum flavidum* Retz., LUZON, Tarlac Province, La Paz, December, 1924, *Clemens 4876*. On *Setaria palmaefolia* (Koenig) Stapf, MINDANAO, Todaya, Mount Apo, June 12 to 15, 1924, *Clemens 2135*.

17. UROMYCES LINEARIS B. and Br.

On *Panicum patens* L., MINDANAO, Todaya, Mount Apo, June 15 to 17, 1924, *Clemens 2014*. On *Panicum repens* L., LUZON, Isabela Province, Dagan and Cagayan, January 17, 1923, *Clemens 1722:* Bulacan Province, November, 1924, *Clemens 4860*.

18. UROMYCES PEGLERIAE Pole Evans. Plate 3, fig. 3.

On *Digitaria chinensis* Nees, LUZON, Benguet Subprovince, Baguio, February, 1925, *Clemens 5793*.

This collection adds an interesting species previously known only from South Africa.

19. UROMYCES ERIOCHLOAE Syd. and Butl.

On *Eriochloa ramosa* (Retz.) Ktze., LUZON, Nueva Vizcaya Province, Bambang, January 21, 1924, *Clemens 1706*.

20. UROMYCES APLUDAE Syd. and Butl.

On *Apluda mutica* L., LUZON, Isabela Province, Iligan, December 22, 1923, *Clemens 1747:* Tarlac Province, Gerona, January, 1925, *Clemens 4949*.

21. UROMYCES POLYTRIADICOLA sp. nov. Plate 1, fig. 2.

Uredia amphigena, brunnea; paraphyses peripheriales, introrsum curvatae, clavatae vel capitatae, 13–17 x 25–35 μ; membrana 1 μ cr., hyalina; urediosporae obovoideae vel globosae, 19–25 x 23–28 μ; membrana 1.5–2 μ cr., cinnamomeo-brunnea, breviter echinulata, poris germ. 3, equatorialibus. Telia amphigena minuta, teliosporae variabiles, globosae vel oblongae, 16–20 x 18–26 μ; membrana 1.5 μ cr., ad apicem 3 vel 4 μ, castaneo-brunnea, levis, pedicelo hyalino, brevi.

On *Polytrias amaurea* (Büse) O. Kuntze, LUZON, Manila, corner of Georgia and Tennessee Streets, January, 1924, *Clemens 4948*.

22. UROMYCES TENUICUTIS McA.

On *Sporobolus indicus* (L.) R. Br., LUZON, Benguet Subprovince, Baguio, February, 1925, *Clemens 5788, 5789*.

23. UREDO OPLISMENI sp. nov.

Uredia hypophylla, minuta, 50–100 μ diam., paraphyses peripheriales, introrsum curvatae, 13–18 x 30–45 μ, membrana 3 μ cr., ad apicem 5 μ, brunnea; urediosporae obovoideae, 17–21 x 22–26 μ; membrana 1.5 μ cr., fulva breviter echinulata, poris germ. Obscuris, verisimiliter 4, equatorialibus.

On *Oplismenus undulatifolius* (Ard.) Beauv., LUZON, Benguet Subprovince, Mount Santo Tomas, February 19, 1925, *Clemens 5786*.

Although no telia could be found on this specimen the character of the uredia indicates that the species may belong in the genus *Angiopsora*.

24. UREDO ARTHRAXONIS-CILIARIS P. Henn.

On ? *Arthraxon* sp., LUZON, Benguet Subprovince, between Camp 30 and Baguio, February 27, 1925, *Clemens 5111;* Adouay region, February, 1925, *Clemens 5111a*. On *Arthraxon quartinianus* Merr. (taken from herbarium mounted sheet), LUZON, Ifugao Subprovince, Polis Pass, February 15, 1913, *R. C. McGregor s. n.* The host is uncertain in the two numbered collections, but the rust appears to be as listed here.

25. UREDO ANDROPOGONIS-ZEYLANICI Petch.

On *Andropogon fragilis* R. Br. var. *malayanus* Merr., LUZON, Benguet Subprovince, between Adouay and Camp 42, February 27, 1925, *Clemens 5113*.

26. UREDO OPERTA Syd. and Butl.

On *Coix lachryma-jobi* L., MINDANAO, Todaya, Mount Apo, May, 1924, *Clemens 1980.*

Uredo operta is described as having spores with three equatorial pores, but this specimen has four to six equatorial pores. Other characters, including paraphyses, agree so closely, however, that a new name does not seem justified without a comparison with type material.

27. UREDO AGROSTIDIS sp. nov. Plate 1, fig. 3.

Uredia amphigena, minuta; paraphyses capitatae, hyalinae; urediosporae globosae, 23–27 x 24–30 μ; membrana 2–3 μ cr., pallide flavida, breviter echinulata, poris germ. 6–8, sparsis.

On *Agrostis elmeri* Merr., LUZON, Benguet Subprovince, automobile road, summit of "hairpin," below Camp 30, February 27, 1925, *Clemens 4982.*

ON CYPERACEÆ

28. PUCCINIA CARICIS (Schum.) Wint.

On *Carex filicina* Nees, LUZON, Benguet Subprovince, Mount Pulog, February 25 and 26, 1925, *Clemens 5017.* On *Carex rafflesiana* Boott, LUZON, Benguet Subprovince, Mount Pulog, February 25, 1925, *Clemens 5102.*

29. PUCCINIA CONSTATA Syd.

On *Carex baccans* Nees, LUZON, Benguet Subprovince, Mount Santo Tomas, February 19, 1925, *Clemens 5800.*

30. PUCCINIA OREOPHILA Syd.

On *Carex rafflesiana* Boott, LUZON, Benguet Subprovince, Mount Pulog, February 25 and 26, 1925, *Clemens 5103.*

31. PUCCINIA OBTECTA Peck.

On *Scirpus articulatus* L., LUZON, Tarlac Province, Paniqui, January, 1925, *Clemens 4959:* Ilocos Norte Province, February, 1907, *E. A. Mearns s. n.*

32. PUCCINIA FIMBRISTYLIDIS Arth.

On *Fimbristylis annua* (All.) R. and S., LUZON, Manila, September 18, 1923, *Clemens 1869.* On *Fimbristylis miliacea* Vahl, LUZON, Cagayan Province, Aparri, January 7, 1924, *Clemens 1751:* Tarlac Province, La Paz, December, 1924, *Clemens 4879, 4880.* On *Fimbristylis* sp., LUZON, Bulacan Province, Santa Maria, November, 1924, *Clemens 4858.*

33. PUCCINIA FUIRENICOLA Arth. Plate 1, fig. 4.

On *Fuirena ciliaris* (L.) Roxb., LUZON, Cagayan Province, Aparri, January 7, 1924, *Clemens 1748.*

Telia have not previously been known for this species, its assignment to *Puccinia* being on the assumption that when found the telia would conform to those of that genus. Telia are present in this collection, and a description follows.

Telia hypophyllous, subepidermal, brown, with brown subepidermal paraphyses; teliospores (Plate 1, fig. 4) oblong or cylindric, 14 to 19 by 45 to 60 μ, rounded, obtuse or narrowed above, narrowed below; wall 1.5 μ thick at sides, 5 to 12 μ at apex, light chestnut-brown, smooth, pedicel persistent, brownish, one-half to once length of spore.

34. PUCCINIA LIBERTA Kern.

On *Eleocharis variegata* Kunth, LUZON, Bulacan Province, Santa Maria, November, 1924, *Clemens 4861.*

Only uredia are present in this collection. The two germ pores are slightly more superequatorial than is typical.

35. PUCCINIA MYSORENSIS Syd. and Butl.

On *Kyllinga brevifolia* Rottb., LUZON, Bulacan Province, Sibul Springs, December, 1924, *Clemens 4944.* On *Kyllinga intermedia* R. Br., LUZON, Benguet Subprovince, below Camp 30, Mount Pulog and vicinity, February 24 to 27, 1925, *Clemens 5108;* Mount Santo Tomas, February 19, 1925, *Clemens 5801.*

36. PUCCINIA PHILIPPINENSIS Syd.

On *Cyperus rotundus* L., LUZON, Tarlac Province, Paniqui, January, 1925, *Clemens 4964a:* Pangasinan Province, Agno River, Rosales and vicinity, February 1 to 14, 1925, *Clemens 5900, 5923a* (no date). On *Pycreus globosus* (All.) Reichb., LUZON, Benguet Subprovince, below Camp 42, February 27, 1925, *Clemens 5107.*

37. PUCCINIA ROMAGNOLIANA Maire and Sacc.

On *Cyperus difformis* L., LUZON, Tarlac Province, near Pura, November, 1923, *Clemens 1864;* La Paz, December, 1924, *Clemens 4878;* Paniqui, January, 1925, *Clemens 4958.*

38. PUCCINIA SCLERIAE (Paz.) Arth.

On *Scleria tessellata* Willd., LUZON, Manila, September 18, 1923, *Clemens 1868.* On *Scleria* sp., LUZON, Benguet Subprovince, Mount Santo Tomas, February 19, 1925, *Clemens 5803.*

39. UROMYCES SCIRPINUS Syd.

On *Scirpus erectus* Poir., LUZON, Nueva Vizcaya Province, Bambang, January 21, 1924, *Clemens 1714:* Pangasinan Province, near Mount Balungao Hot Spring, Rosales, February 1 to 14, 1925, *Clemens s. n.*

40. UREDO PERIDIATA sp. nov. Plate 2, figs. 4 and 5.

Uredia hypophylla, minuta, plus minus aequaliter distributa; peridio ex cellulis composito, cellulis cubicis, 11–16 μ, fulva vel hyalina, 1.5–2 μ cr.; urediosporae ellipsoideae vel globosae, 20–28 x 25–35 μ; membrana 1.5 μ cr., pallide fulva vel fere hyalin, dense et breviter echinulata, poris germ. obscuris.

On *Carex rafflesiana* var. *scaberrima* (Boeck.) Kükenth., LUZON, Benguet Subprovince, Mount Santo Tomas, February 19, 1925, *Clemens 5795.*

This is a distinctive species and is unique among the rusts of *Carex* because of its well-developed peridium, which resembles the peridia of some melampsoraceous genera. The peridium opens by apical rupture but appears to lack special ostiolar cells. Near the base of the sorus the cells of the peridium become longer and have thinner walls. The urediospores offer no special features.

Without telia the generic position of this species must remain uncertain, but it seems probable that it is related to *Angiopsora*, a genus not reported as occurring on sedges.

ON COMMELINACEÆ

41. UREDO DAVAOENSIS Syd.

On *Cyanotis axillaris* (L.) R. and S., LUZON, Manila, near San Francisco Church, October 9, 1923, *Clemens 1602.*

ON ARACEÆ

42. PUCCINIA RHAPHIDOPHORAE (Sacc.) Syd.

On *Rhaphidophora Merrillii* Engl., LUZON, Tarlac Province, Gerona, January, 1925, *Clemens 4950.*

ON LILIACEÆ

43. UREDO DIANELLAE Diet.

On *Dianella ensifolia* (L.) DC., LUZON, Benguet Subprovince, Mount Pulog and vicinity, February 24 to 27, 1925, *Clemens 5120.* On *Dianella javanica* (Bl.) Kunth, LUZON, Benguet Subprovince, Mount Santo Tomas, February 19, 1925, *Clemens 5806.*

44. PUCCINIA CITRINA Syd. Plate 3, fig. 2.

On *Smilax* sp., MINDANAO, Mount Apo, Thermal Springs, May 31, 1924, *Clemens 2026, 2027.*

Pycnia but no aecia are present in *2026* which also has abundant uredia and a few teliospores. The urediospores agree with those described for *P. citrina* and the teliospores differ only in having pedicels which are not especially persistent, but since most of them appeared to be rather immature this may not be significant.

Pycnia and aecia are present on *2027*, and because the aeciospores agree with the urediospores of *P. citrina* in the apical thickening of the wall it is considered probable that these aecia belong in the life cycle of *P. citrina.* Both collections were made at the same locality and on the same day. A description of the pycnia and aecia follows.

Pycnia subepidermal, amphigenous, 100 to 150 μ in diameter. Aecia (Plate 3, fig. 2) amphigenous, on slightly hypertrophied veins with the pycnia, deep-seated, with an easily separable peridium; aeciospores oblong or obovoid, 22 to 29 by 30 to 39 μ; wall 2 to 3 μ thick at sides and base, thickened 5 to 12 μ above, colorless or pale yellowish, closely and coarsely verrucose with nearly cubical sculpturing.

45. PUCCINIA MERRILLII P. Henn.

On *Smilax bracteata* Presl, LUZON, Pangasinan Province, Rosales and vicinity, February 1 to 14, 1925, *Clemens 5902.* On *Smilax* ? *china* L., LUZON, Benguet Subprovince, Adouay, February 24, 1925, *Clemens 4948.*

46. PUCCINIA SMILACIS-CHINAE P. Henn. Plate 3, fig. 1.

On *Smilax china* L., LUZON, Benguet Subprovince, Mount Pulog, February 25, 1925, *Clemens 4983.*

A single uredium was found on this collection and the urediospores corresponded to those of *P. smilacis-chinae.* Pycnia and aecia were also present and are considered to belong with this species. The aecia and aeciospores are large and easily distinguished from those described for *P. citrina.* A description follows.

Pycnia amphigenous, on slightly hypertrophied areas on the veins, petioles and stems, subepidermal, 100 to 200 μ in diameter. Aecia (Plate 3, fig. 1) amphigenous, among the pycnia, deep-seated, with an easily separable peridium; aeciospores oblong, sometimes narrowed above, 23 to 32 by 42 to 60 μ; wall 3 to

5 μ thick at sides and base, thickened 10 to 20 μ above, closely and coarsely verrucose.

The taxonomy of the rusts on *Smilax* appears to need careful study and possible revision. Inoculation experiments would do much to clear up the confusion. The descriptions of aecia given in this paper for *P. citrina* and *P. smilacis-chinae* and the suggestions of the probable relationship of these aecia are made with the hope that botanists located in regions where these species occur may undertake to study their life histories experimentally. In the meantime there would seem to be little advantage in giving specific names under the form-genus *Aecidium*, although the aecia described here can be readily distinguished.

ON DIOSCOREACEÆ

47. UREDO DIOSCOREAE-FILIFORMIS Racib.

On *Dioscorea nummularia* L., MINDANAO, Mount Apo, Todaya, May 27, 1924, *Clemens 1982.*

48. UREDO DIOSCOREAE-SATIVAE Syd.

On *Dioscorea fiabellifolia* Prain and Burkill, MINDANAO, Mount Apo, Todaya, May, 1924, *Clemens 2021.* On *Dioscorea hispida* Dennst., MINDANAO, Mount Apo, Todaya, May 26, 1924, *Clemens 1976.*

The collections reported here were found to differ from the published descriptions of species of *Uredo* on *Dioscorea* in having a peridium. The cells are cubical at the top of the peridium but become oblong toward the sides. The wall is about 2 μ thick and somewhat brownish. In most preparations the peridium is so collapsed that it is overlooked but it can be seen in thin sections.

In attempting to identify these collections a specimen of *Uredo dioscoreae-pentaphyllae* Petch was sectioned for study. This collection was made by Petch on *D. pentaphylla* at Kandy, Ceylon, January 12, 1912, and possibly is a part of the type collection. A peridium was also found which agreed with that in the Clemens collections. Sydow [4] considers that Petch's species is the same as his *U. dioscoreae-sativae,* but since he describes no peridium and since we have no specimen of *U. dioscoreae-sativae* for comparison we cannot be certain of the identity of the two fungi upon which these names are based. We accept Sydow's opinion, however, on the assumption that he overlooked the peridium as did Petch.

[4] Mono. Ured. 4 (1924) 514.

The species differs from *Uredo dioscoreae-filiformis* in having smaller, more finely echinulate spores and in the possession of a peridium. *Uredo dioscoreae-alatae* Racib. appears to be similar, but the sori are situated much deeper in the leaf. In the material of this species at our disposal we were unable to distinguish a peridium. These three species appear to be closely related.

ON AMARYLLIDACEÆ

49. PUCCINIA CURCULIGONIS Racib.

On *Curculigo capitulata* (Lour.) Ktze., LUZON, Benguet Subprovince, Santo Tomas, February 19, 1925, *Clemens 5805*. On *Curculigo orchioides* Gaertn., MINDANAO, Davao Province, below Sibulan, May, 1924, *Clemens 4927*.

ON ZINGIBERACEÆ

50. UREDO COSTINA Syd.

On *Costus speciosus* Sm., MINDANAO, Mount Apo, Todaya, June, 1924, *Clemens 1973*.

ON ORCHIDACEÆ

51. COLEOSPORIUM MERRILLII P. Henn.

On *Calanthe furcata* Batem., LUZON, Benguet Subprovince, Baguio, February, 1925, *Clemens 5804*.

ILLUSTRATIONS

PLATE 1

FIG. 1. *Angiopsora Clemensae* Arth. and Cumm., a telium, showing the sessile catenulate teliospores and the compact, subepidermal nature of the sorus; × 650. (Anda, Luzon, March, 1925, *Clemens s. n.*)

2. *Uromyces polytriadicola* Arth. and Cumm., one urediospore and one teliospore; × 650. (*Clemens 4948.*)

3. *Uredo agrostidis* Arth. and Cumm., one of the capitate paraphyses and one urediospore showing the characteristic arrangement of the germ pores and the relatively thick wall; × 650. (*Clemens 4982.*)

4. *Puccinia fuirenicola* Arth., two teliospores; × 650. (*Clemens 1748.*)

PLATE 2

FIG. 1. *Puccinia rufipes* Diet., teliospores; × 500. (Paniqui, Luzon, January, 1925, *Clemens s. n.*)

2. *Puccinia polliniae-quadrinervis* Diet., teliospores; × 500. (*Clemens 5013.*)

3. *Puccinia subcentripora* Arth. and Cumm., one teliospore showing the pore midway to pedicel in the lower cell; × 500. (*Clemens 5898.*)

4. *Uredo peridiata* Arth. and Cumm., a uredium; × 100. (*Clemens 5795.*)

5. *Uredo peridiata* Arth. and Cumm., a section of a uredium showing the cellular peridium situated just beneath the epidermis of the host; × 500. (*Clemens 5795.*)

PLATE 3

FIG. 1. *Puccinia smilacis-chinae* P. Henn., a section of the aecia. The apical thickening of the walls of the aeciospores can be seen in some spores. A single pycnium also shows; × 100. (*Clemens 4983.*)

2. *Puccinia citrina* Syd., a section of an aecium; × 100. (*Clemens 2027.*)

3. *Uromyces pegleriae* Pole Evans, a teliospore; × 500. (*Clemens 5793.*)

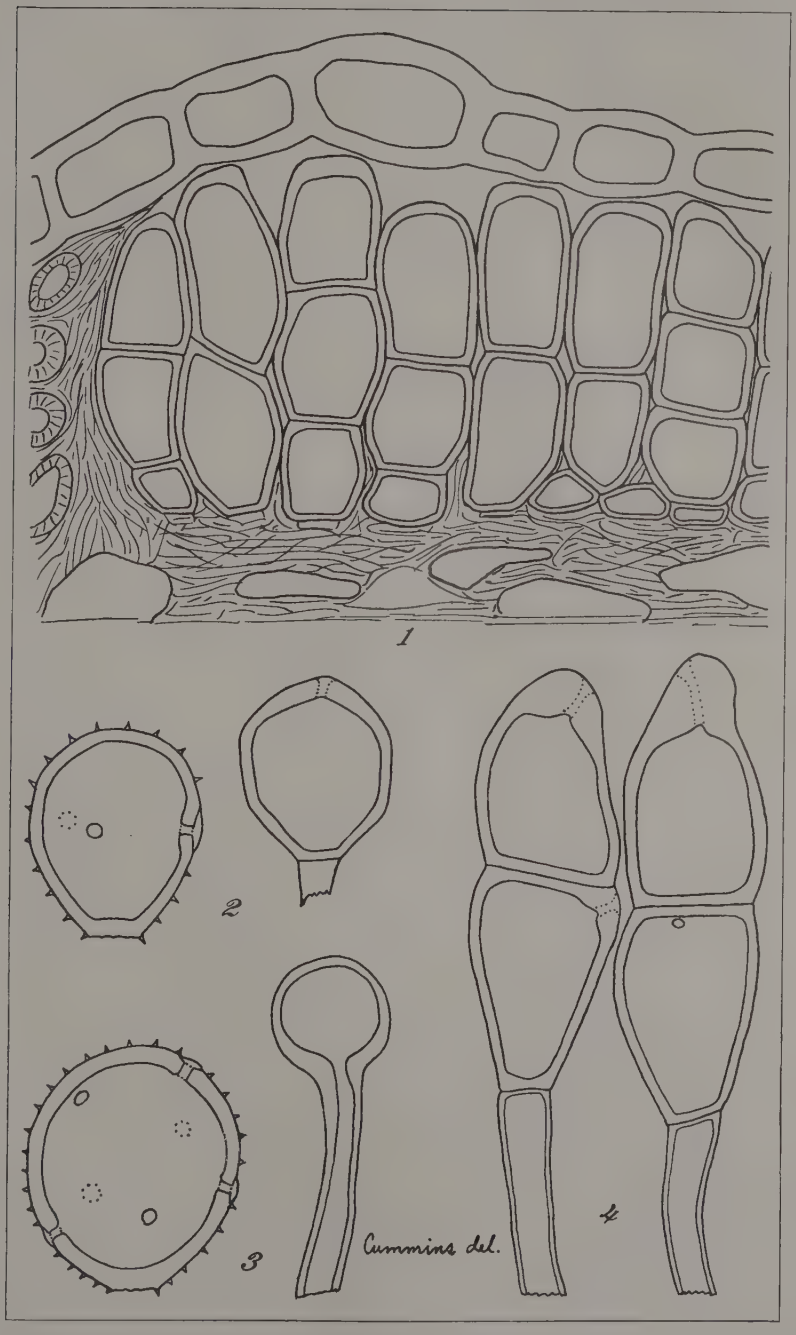


PLATE 1.

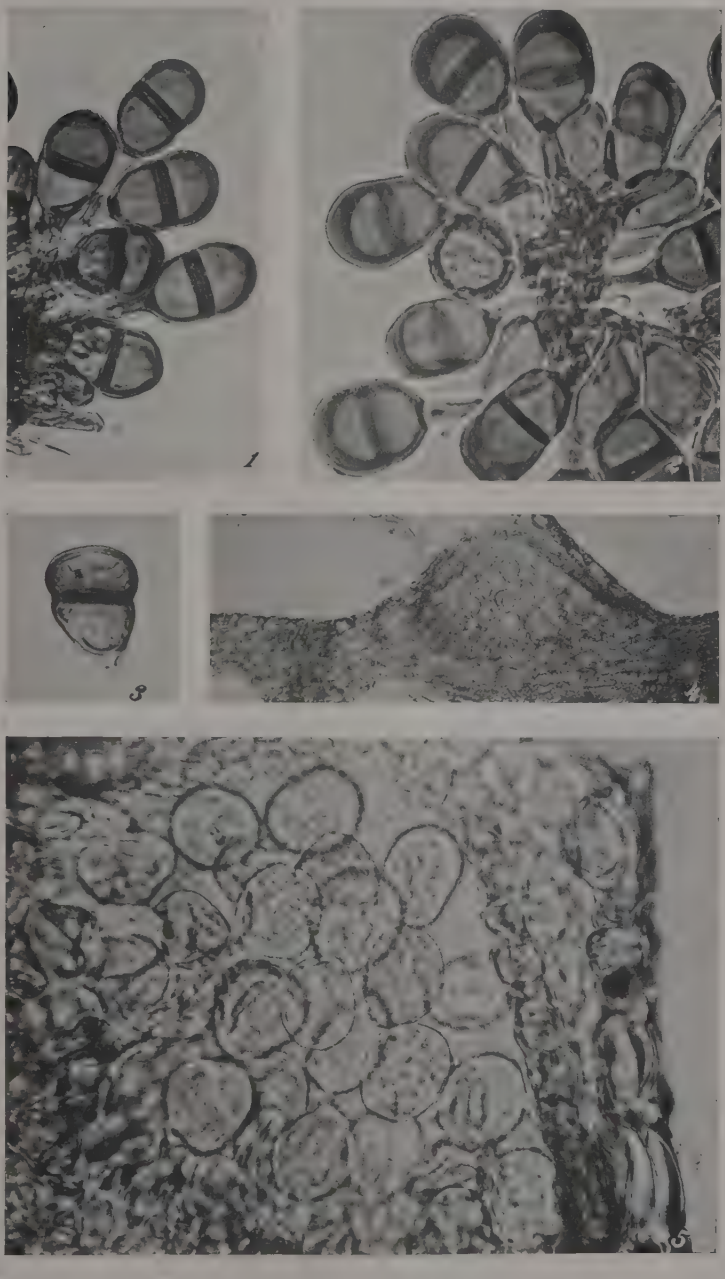


PLATE 2.

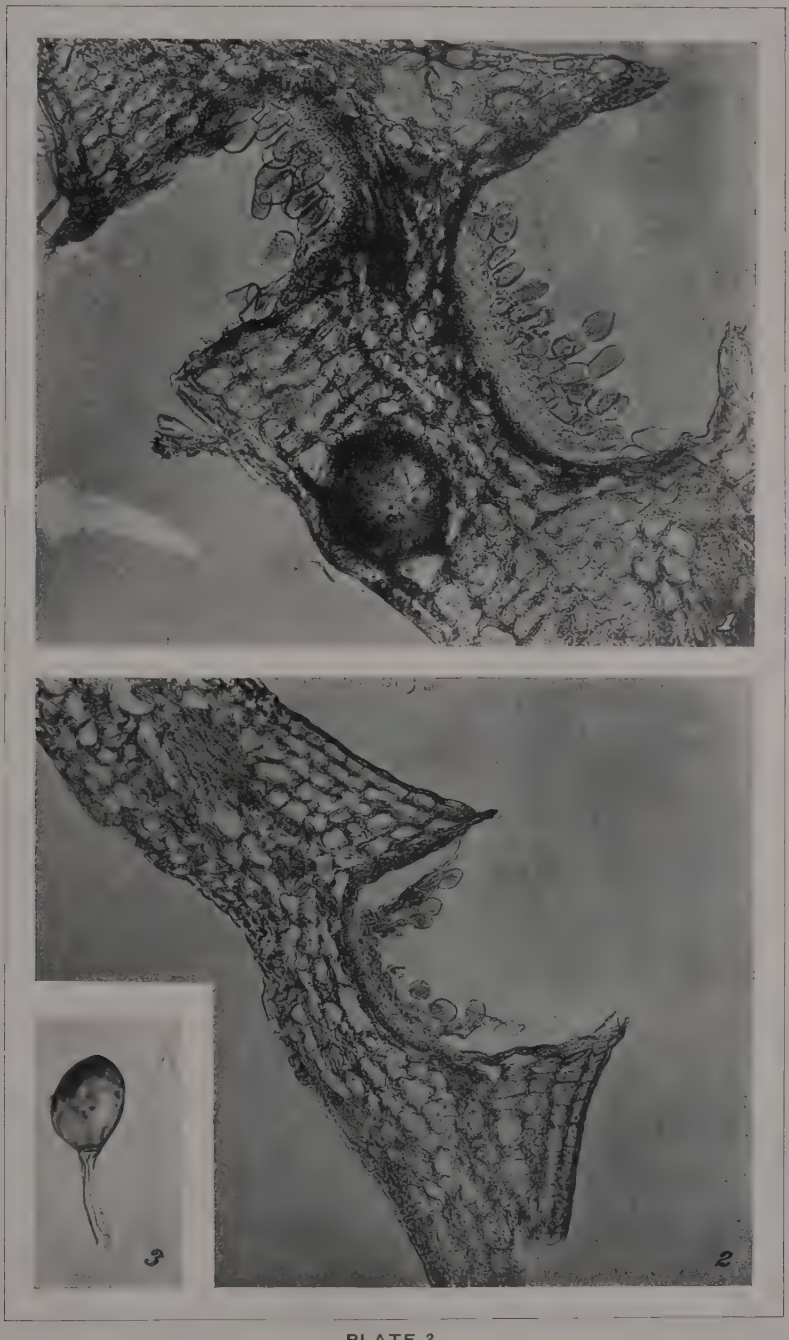


PLATE 3.

THE IDENTITY OF CONVOLVULUS REPTANS LINNÆUS

By E. D. Merrill

Administrator of Botanical Collections, Harvard University, Cambridge

ONE PLATE

In 1910 Hallier f. noted[1] that the actual specimen of *Convolvulus reptans* Linn. in the Linnæan herbarium represents the species interpreted by him as *Merremia caespitosa* (Roxb.) Hall. f., a disposition of the Linnæan species that is totally at variance with the generally accepted application of the Linnæan binomial which has been assumed by most authors to represent the very different *Ipomoea reptans* Poir. (*I. aquatica* Forsk.). The original Linnæan description, reproduced below, clearly indicates that it was based on the specimen now in the Linnæan herbarium and that it represents a species very different from *Ipomoea reptans* Poir.

Convolvulus reptans Linn. Sp. Pl. (1753) 158.

CONVOLVULUS foliis hastato-lanceolatis; auriculis rotundatis, caule repente, pedunculis unifloris. *Ballel* Rheed. mal. II. p. 107, *t. 52.*

Habitat in India.

Planta ex minoribus. Caulis filiformis, nec volubilis. Folia lanceolata, basi auricula utrinque recurvata, obtusa, glabra, angusta, acuminata, petiolis brevissimis insidentia. Pedunculi breves, uniflori. Calyx rotundatus.

The specimen on which the above description was based, so labeled by Linnæus, was in the herbarium in 1753, and Plate 1 represents a photographic reproduction of it.

The current misinterpretation of the Linnæan binomial is due to Linnæus's own error in citing *Ballel* Rheede, Hort. Malabar. 11: 107, *pl. 52,* as representing his species. This illustration is a good representation of *Ipomoea reptans* Poir. = *I. aquatica* Forsk. That Linnæus himself interpreted *Ballel* as representing his species, in spite of the fact that it did not conform at all closely with the characters of the specimen on which his original description was based, is evidenced by his treatment of *Olus vagum* Rumph., Herb. Amb. 5: 419, *pl. 155, fig. 1,* which in 1754, 1759, and 1762 he referred to *Convolvulus reptans;* Rumphius's figure is a good illustration of *Ipomoea reptans* Poir. = *I. aquatica* Forsk.

[1] Med. Rijks Herb. Leiden 1 (1910) 21.

In view of the factors involved the correct interpretation of *Convolvulus reptans* Linn. is as representing a *Merremia*, for those that recognize this genus, but not as representing *Ipomoea reptans* Poir. = *I. aquatica* Forsk. The synonymy of the two species involved is given below.

MERREMIA HIRTA (Linn.) Merr. Plate 1.

Merremia hirta (Linn.) MERR. in Philp. Journ. Sci. Bot. 7 (1912) 244, Enum. Philip. Fl. Pl. 3 (1923) 361.
Convolvulus hirtus LINN., Sp. Pl. (1753) 159; HALL. F. in Meded. Rijks Herb. Leiden 1 (1910) 21.
Convolvulus reptans LINN., Sp. Pl. (1753) 158; HALL. F. in Meded. Rijks Herb. Leiden 1 (1910) 21.
Convolvulus cæspitosus ROXB., Hort. Beng. (1814) 14, *nomen nudum*, Fl. Ind. 2 (1824) 70.
Ipomoea linifolia BLUME, Bijdr. (1826) 721.
Skinneria cæspitosa CHOISY in Mém. Soc. Phys. Hist. Nat. Genève 6 (1833) 487, *pl. 6;* Conv. Or. (1834) 105, *pl. 6.*
Ipomoea philippinensis CHOISY in Mém. Soc. Phys. Hist. Nat. Genève 6 (1833) 475; Conv. Or. (1834) 93.
Ipomoea setulosa ZOLL. and MOR., Syst. Verzeich. (1845) 51.
Ipomoea hepaticifolia BLANCO, Fl. Filip. ed. 2 (1845) 72.
Merremia cæspitosa HALL. F. in Engl. Bot. Jahrb. 16 (1892) 552.

Hallier f., who examined both Linnæan types, states that they represent a single species for which he adopted the name *Merremia caespitosa* (Roxb.) Hall. f. I follow his interpretation of *Merremia caespitosa* as including forms with glabrous and with more or less hairy stems, and with distinctly variable leaf characters as to shape and size. It may be noted that *Convolvulus reptans* Linn. has page priority over *C. hirtus* Linn., but priority of place is not recognized under the International Code of Botanical Nomenclature. This variable species is one of wide geographic distribution, extending from India to southern China, through Malaysia and the Philippines to tropical Australia.

IPOMOEA AQUATICA Forsk.

Ipomoea aquatica FORSK., Fl. Aeg.-Arab. (1775) 44.
Ipomoea reptans POIR. in Lam. Encycl. Suppl. 3 (1814) 460 non *Convolvulus reptans* Linn.
Convolvulus repens VAHL, Symb. 1 (1790) 17.
Convolvulus adansoni LAM., Encycl. 3 (1791) 560.
Ipomoea subdentata MIQ., Fl. Ind. Bat. 2 (1856) 614.

Widely distributed in the Old World Tropics, in southern China commonly cultivated or semicultivated. Throughout its range the young shoots are commonly used as a pot-herb, as are the young shoots of the sweet potato, *Ipomoea batatas* Poir.

ILLUSTRATION

PLATE 1. *Convolvulus reptans* Linn., type specimen in the Linnæan herbarium=*Merremia hirta* (Linn.) Merr.

PLATE 1.